JUN 16 1924

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FOUNDED 1872

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See page xl.

Advertisement Index, see page xliv. *Official Notices, see Sup. 34.*

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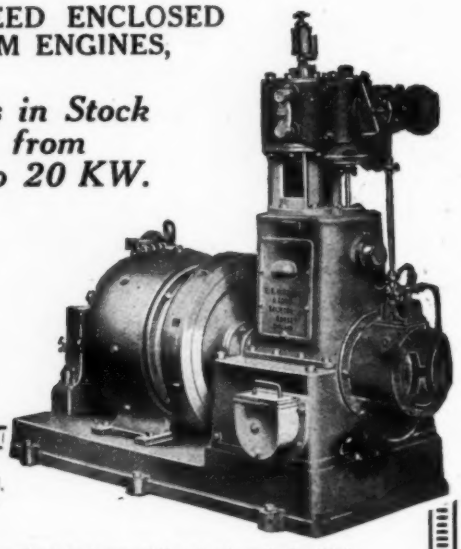

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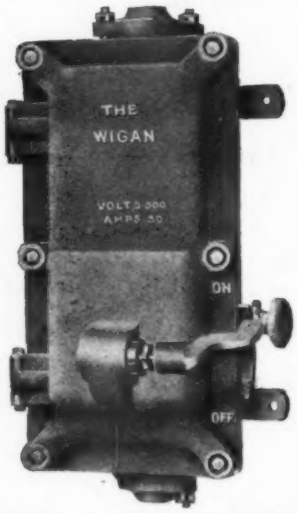

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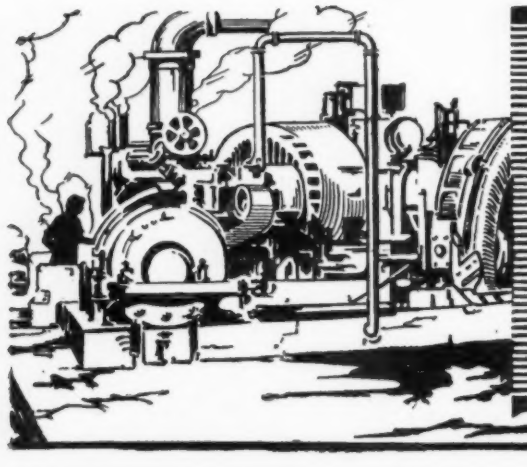

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The

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LIST OF FOREIGN AGENTS (see first page "Official Notices").

Contents:

	PAGE
The Patents Report	905
Electricity to Save Agriculture	906
The Mining Congress	906
Non-ferrous Electric Furnaces	906
Power Transmission Lines—II, by William T. Taylor (*Illus.*)	907
Morse *v.* Broadcasting, by M. S. Mason	909
Magnetic Separation	910
Protective Resistances and Fuses for Potential Transformers, by C. A. Wilson	912
Parliamentary	912
"After-hours" Shop-window Lighting (*Illus.*)	913
Legal	914
Some Notes on Increasing the Sales of Electricity, by Julian G. Thain	915
Reviews	916
Business Notes	917
Lighting and Power Notes	921
Tramway and Railway Notes	923
Telegraph and Telephone Notes	923
Radio Notes	923
Contracts Open and Closed	924
The Tirso Hydro-electric Scheme (*Illus.*)	925
A Modern Electric Flat, by L. L. Robinson	929
Forthcoming Events	930
Notes	930
Institution Notes	932
Our Personal Column	932
New Companies Registered	932
Official Returns of Electrical Companies	932
City Notes	933
Stocks and Shares	935
Some of the Exhibits at Wembley (*Illus.*)	937
The London Electricity Supply Problem (*continued*)	941
Power Circuit Interference with Telegraphs and Telephones	943
Italy's Electrical Trade	944
New Electrical Devices, Fittings, and Plant (*Illus.*)	945
Correspondence—	
Pulverised Coal	946
Pulverised-coal Firing	946
Applications for Situations	946
The Domestic Load	946
Positive Predominates	947
Wood for Underground Conduits	947
A Mysterious Short Circuit	947
Verbose Specifications	947
Atoms and Isotopes, by Dr. F. W. Aston	947
Published Specifications	948
Contractors' Column	Advertisement page xxx

The Patents Report.

THE annual report of the Comptroller-General of Patents, for the year 1923, shows total receipts from patent fees of £393,000, as compared with £413,000 in 1922. On the expenditure side, on the other hand, there is a decrease of nearly £18,000 in salaries. The surplus of receipts over expenditure is £81,797; this is the item which most interests us, as it is presumably being handed over to the Treasury as usual, being in effect a tax on brains. With the general conduct of the Patent Office we have no quarrel at all. A glance through the salary list shows that the staff is not overpaid, nor, we believe, excessive in number. The work is done well and economically in accordance with the existing law. Nevertheless, our patent arrangements put us at an enormous disadvantage as compared with other manufacturing countries, and especially as compared with the United States. There, as we have often pointed out before, a first and final fee of £7 covers 17 years' genuine protection in every State of the Union.

In this country, as is well known, the first payment of £4 gives protection for four years, after which fees increasing by £1 a year, namely, £5 for the fifth year, £6 for the sixth year, and so on. . . are payable for the whole of the 16 years, or a total of £130 for the whole life of the patent; and the area covered comprises only Great Britain and Ireland. Even if these large fees protected an inventor throughout the whole of the British Empire, he would still be at a disadvantage as compared with an inventor in the United States, by reason of the heavy renewal fees. But when it is remembered that there is a separate Patent Law in every constituent of the Empire, with separate large fees in each case, it will readily be seen that only a very rich man can secure Empire protection for any

invention, however meritorious. Our Empire builders might very well turn their attention to this question with a view to securing an Empire Patent Law.

A very interesting appendix is attached to this excellent and concise report, giving the life history of the patents taken out in the years from 1908 to 1921. This shows that only 35 per cent. of the patents applied for in 1908 reached their fifth year, 27 per cent. the sixth year, 20 per cent. the seventh year; 16 per cent. reached middle age, their eighth year, but only 14 per cent. reached the ninth, 12.6 per cent. the tenth, 10.7 per cent. the 11th, 9.7 per cent. the twelfth, 9.4 per cent. the thirteenth, 7.3 per cent. the fourteenth, and 5.5 per cent. the fifteenth year. Those that reached the allotted span of 16 years numbered only 4.1 per cent. of the original patents filed. People who are essentially opposed to patents as putting obstacles in the way of manufacturers, some of whom would prefer a practically clear field, might say that it was all to the good that so many patents should fall into the public domain at such an early age. On the other hand, however, it is perfectly clear that if the British Patent is designed as a means of encouraging invention, it fails entirely in its object—84 per cent. of the inventors of the year 1908 having given up the maintenance of their patents in despair at the eighth year, or middle age. What tragedies lie behind these figures can easily be surmised. It has come to be an accepted theory that an inventor is a man who starves in a garret, and dies in a ditch; and the reception of men with patents by the moneyed class clearly indicates their status in the commercial world. There are, of course, brilliant exceptions, mostly inventors who have business acumen as a rare addition to their inventive faculties, and capital either of their own or their friends available; but these exceptions only prove the rule.

We would appeal to this Government, as we have appealed to its predecessors, to consider whether it would not pay, merely from an income tax point of view, to arrange for an Empire Patent with a single preliminary fee paid down; and to reorganise the whole system on the basis that it would be more profitable for the State to have a large number of successful patents than to receive the sum of £81,000 a year in the form of a brain tax collected by the Patent Office. The United States has long profited by adopting the policy which we now advocate, and we know of no inherent reason why the British Empire should be unable to do the same.

Electricity to Save Agriculture.

THE Agricultural Tribunal of Investigation appointed by the Minister of Agriculture recently issued its final report, stating that in this country there had been a greater decline in agricultural employment than in the rest of Europe, though wages here were higher than elsewhere. The terms of reference invited the Tribunal to inquire into the methods which had been adopted in other countries during the last 50 years to increase the prosperity of agriculture and to secure the fullest possible use of the land, and various recommendations were made by the Tribunal, but these referred largely to co-operation and similar matters.

It is well known to our readers that during recent years remarkable progress has been made on the Continent in the application of electricity to agriculture; Mr. R. Borlase Matthews has given particulars and data on the subject in his articles on "Electro-farming," and at the British Empire Exhibition he has organised (for the E.D.A.) an interesting exhibit demonstrating methods of utilising electricity on the farm. No mention, however, of this important factor appears to be included in the recommendations of the Tribunal. Not only would it greatly facilitate farming operations, enabling them to be carried on in many cases irrespective of the weather; it would also permit of farming being conducted on a larger and more profitable scale, with the same amount of labour, and would import an element of interest into the work, together with greater comfort in the home, which would tend to counteract the flow of the population from the country to the town. In this industry, as in others, the greater use of machinery is vital to the solution of the problem of increasing output and reducing the cost of production, whilst maintaining a high rate of wages and a high standard of living.

The Mining Congress.

AMONGST the first of the important functions that are to take place at the British Empire Exhibition is the Empire Mining and Metallurgical Congress, which concludes its sittings to-day. It has brought together a vast amount of information regarding the mineral resources of the Empire, including liquid and solid fuel, and their utilisation, 34 papers having been contributed mainly by well-known experts in the respective subjects. With the exception of a paper on "Problems of Mechanical Coal-Mining," by Mr. Sam Mavor, and one on "Electricity in Coal Mines," by Mr. Robert Nelson, there is little in the proceedings of immediate interest to electrical engineers, but indirectly, of course, the electrical industry is intimately concerned with the deliberations of the Congress. It is understood to be the intention of the promoters to establish an Empire Council of Mining and Metallurgical Institutions, which, it is hoped, will become a permanent body; and one important matter that is being discussed is the question of professional status and the establishment of a register of properly-qualified engineers engaged in mining or metallurgy.

Non-ferrous Electric Furnaces.

THE statement is frequently made that the slow progress that has been made by the electric furnace has been due to the high cost of electricity. This is no doubt true up to a point, but there are users of electric furnaces who dispute it. The price of energy at most of the works in America where electric furnaces are used is about the same as in this country, and yet it is stated that over 2,500,000 lb. of brass per day is being melted in one type of furnace alone in the United States.

It has been shown that a variation of one-tenth of a penny per kWh makes a difference of only two shillings per ton of brass melted, which shows that although the cost of energy may be, and indeed is, an important factor, it is not an absolutely determining factor. The conservatism of brass founders has something to do with their reluctance to install electric furnaces, and the prolonged depression has undoubtedly prevented the laying-down of new plant. The non-ferrous electric furnace has passed the experimental stage. It is recognised by users to be both an efficient and an economical melting unit, but there is a large number of small brass foundries whose proprietors will have to be educated up to the advantages of the electric furnace and made to realise the wastefulness of the coke furnace. The cost of energy has fallen very considerably in many districts during the past year.

Power Transmission Lines.—II.*

Aspects of their Design.

By WILLIAM T. TAYLOR, M.Inst.C.E., M.I.E.E., Fel. A.I.E.E.

THE factors known or assumed in the calculation of the electric circuits of aerial power transmissions are: the delivered power; load-power factor; delivered voltage; total transmission distance (allowing for conductor sag); average or effective spacing of the conductors; size of the conductors; the system, phase, and the frequency. Of all these factors, few are actually fixed. As regards the receiving voltage, this is dependent upon the power and power-factor, and is regulated at the generating station, the endeavour being to keep it at a fixed value. Both the power and power-factor vary from time to time according to the changes in load. Other variable line conditions to be expected are: —

(*a*) Variation of the line constants R and X due to changes in the kW load and line current I, &c.

(*b*) Uncertainty of the actual effective spacing of the line conductors, which changes with the spans and conductor-metals used and also with the variation of sag due to wind, sleet, and ice loadings, temperature changes, &c.

(*c*) Variations of R due to changes in temperature different to that upon which original calculations were made.

(*d*) Uncertainty (at the time of design or erection) of the actual length of the conductors, which also may vary somewhat with the sags, due to tension or stress on the conductors and to changes in temperature, &c.

(*e*) Variation of inductance L due to changes from the originally known or calculated diameter of *stranded* conductors employed to the actual diameter, which may be changed due to stretching of the conductor, to temperature changes, to its manufacture and/or permeability, or to the use of a steel core or strands, &c.

(*f*) Difference in the conductivity and/or the permeability of the conductors from the value calculated or accepted from manufacturers' tables or figures.

(*g*) Change in the inductance L and/or resistance R due to proximity and/or skin effects, both of which may tend to increase R and decrease the value of L.

It therefore seems evident that the original factors and the line constants (known and/or assumed) will in one way or other be dependent upon some of the above-mentioned conditions. With regard to the maximum temperature range to be applied in the design, which varies greatly for the different countries, but ranges from about 50° C. down to 0° C. for this country, the basis of design may follow along the lines of excess or maximum mechanical stress (least sag, greatest loading, &c.) viewpoint for *winter* conditions, and excess or maximum electrical power and voltage losses (highest resistance, &c.) viewpoint for *summer* conditions; considering at the time of design, the greatest conductor sag during the summer months.

The best that can be done is to take the average value of power, voltage, and power-factor; determine the effective or the average spacing for the best or any particular arrangement of the conductors; obtain the actual transmission distance *plus* the length of conductors for sag at zero and at relatively high temperature respectively—*i.e.*, the maximum temperature range—depending on the particular locality and climatic conditions, &c.; choose a conductor-metal to best suit the climatic conditions and the most economical span of line-supports for the particular locality, loading, type of insulators, voltage, and amount of delivered power; to calculate electrical characteristics for the average and the maximum temperature range of the conductor; and to obtain accurate conductivity values of the metal used. As we are not in this text considering the *most economical design* of a transmission line, which is governed by other factors, as, for instance, the load-factor, interest on first cost, the most economical voltage, most economical span of line-supports, the most economical size of conductor, the most economical transmission distance, &c., &c., it will suffice for the moment to keep in mind some of the factors mentioned above when making calculations for the electric circuit of aerial power transmission and distribution lines.

In calculating for voltage drop or power loss it is usual to specify circuit factors in terms of delivered load and general receiving end conditions, and to reduce the delivered power (in terms of delivered voltage and load-power factor) to load-current values. For a new line, or for an extension of an existing line, it is better to apply conditions for the size of conductor than to take a certain allowable voltage drop or power loss. If the voltage drop or power loss is assumed, it will usually be found that the size of conductor falls between two standard commercial sizes, one or the other of which must be chosen—hence a calculation must be made in any case for a chosen size of conductor as found from Chart I, in order to determine the voltage drop or power loss for the actual size of conductor to be used. The accompanying chart (Chart II) should be useful to those designing or operating d.c. or a.c. overhead lines or underground (insulated) cable systems, and desiring to know :—

1. The power loss, size of conductor, or the voltage regulation in a.c. aerial power lines operating below 66,000 volts and for distances of less than 50 miles.

2. The voltage drop or power loss or size of conductor in d.c. aerial power lines or underground cable systems.

Knowing the size and length of conductor, the power, and the total load current, the power loss can be obtained on looking up the ohmic resistance values R given in the accompanying chart. This, of course, will be found unnecessary as Chart I may be used. However, more often than not it is the voltage drop which forms the basis of calculations for a.c. systems and aerial power lines. Such systems are not only dependent upon the value of R, but they are also dependent upon the magnetic flux in and surrounding the conductors, the frequency, the size, spacing and the arrangement of the conductors, the line current, and the load power-factor. The magnetomotive force set up in the conductor is proportional to the line current I; the magnetic flux density is greatest at the surface of the conductor. Neglecting proximity and skin effects, for aerial power lines the fundamental formula for the induced e.m.f. (total effective inductance) per mile of single conductor is expressed—

$$L = 0{\cdot}0804673 + 0{\cdot}7411536 \log_{10} s/r \text{ millihenries} \quad (6)$$
$$= (80{\cdot}4673 + 741{\cdot}1536 \log_{10} s/r) \times 10^{-6} \text{ henries.} \quad (6a)$$

This *induced* counter e.m.f. is proportional to the frequency *f* and the current I; for a symmetrical three-phase or for a single-phase aerial line we can express the total counter e.m.f. per mile of single conductor—

$$IX = 2\pi f IL = 6{\cdot}283 f IL. \quad \ldots \quad (7)$$

The chart values are based on the following formulæ for inductive reactance (volts per ampere) per mile of single conductor—

$$2\pi f (0{\cdot}08047 + 0{\cdot}741 \log_{10} s/r)$$
$$2\pi f (80{\cdot}47 + 741 \log_{10} s/r)\, 10^{-6} \ldots \quad (8)$$

It is assumed here that the conductors for the different phase-wires of a three-phase line are transposed so that the voltage drop is the same for each phase. If the conductors are irregularly spaced, the voltage drop due to the inductive reactance will not be the same in each phase-wire. For an irregular flat or triangular (not an equilateral triangular) spacing, the *average* reactance per conductor or phase-wire is calculated from the formula : $S = \sqrt[3]{A\,B\,C}\ldots(4a)$; where A, B and C are respectively the irregular spacings.

Example : Determine the average spacing S for a three-phase line consisting of three No.1/0 L.S.G. hard drawn copper conductors supported on one cross-arm, such that A = 36 inches; B = 72 inches, and C = 108 inches; then—

* Part I of this series appeared in the ELECTRICAL REVIEW for May 16th, 1924.

$s = \sqrt[3]{36 \times 72 \times 108} = \sqrt[3]{279{,}936} = 65{\cdot}5$ inches, the inductive reactance per mile of single conductor, from Chart II, is 0·635 ohm for a 50-cycle system. For three-phase regular flat or vertical spacings with the same spacing A between the two outside and the middle line-conductors, the *average* reactance per conductor is calculated from the formula ; $s = 1{\cdot}26A$ ...(4*b*). Thus, if A = 54 inches, then the average spacing of the three conductors is $1{\cdot}26 \times 54 = 68{\cdot}0$ inches ; reactance for conductor of No. 1/0 L.S.G. and 50-cycle system is (from chart) 0·645 ohm. We thus see that, for unsymmetrical arrangements of line conductors, the inductive reactance is higher, longer cross-arms are required, and in some cases larger poles are required. Moreover, the average spacing s usually represents a fractional number, as shown in these two examples. The accompanying chart (Chart II) is so designed that the inductive reactance for any odd or fractional value of the average spacing, in inches, can be obtained at a glance.

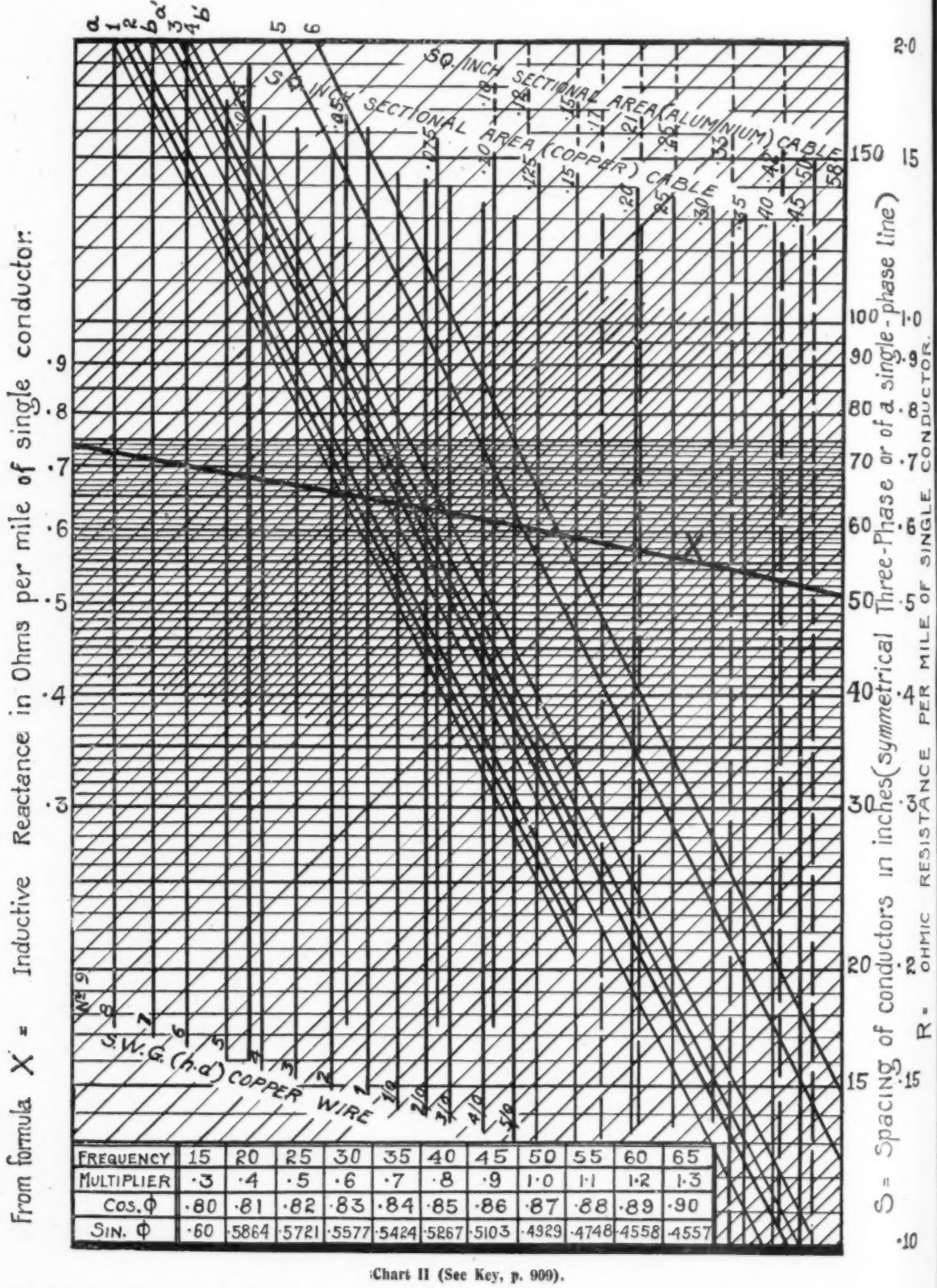
From formula X = Inductive Reactance in Ohms per mile of single conductor
S = Spacing of conductors in inches (symmetrical Three-Phase or of a single-phase line)
R = OHMIC RESISTANCE PER MILE OF SINGLE CONDUCTOR.
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Chart II (See Key, p. 909).

In all the above formulæ for reactance, s = spacing between two of the line-conductors in inches (for a three-phase circuit the chart values are correct where conductors are regularly spaced at the corners of an equilateral triangle); r = radius of the conductors in inches.

Conductor-spacings are dependent upon the line voltages and the sags, *i.e.*, the spans. The sag of each conductor depends upon the size, strength and weight of the conductor, the ice, sleet and wind loads, and the square of the span. We can express roughly the conductor-spacing in terms of inch-volts or ft.-volts; that is to say: (*a*) 1·0 to 1·2 inches per 1,000 volts; or (*b*) 1·0 ft. per 10,000 volts, with a minimum conductor-spacing in each case of from 15 to 30 inches depending on the span, size and weight of conductors, locality, climate, line voltage and the sag. For spacing of hard drawn copper conductors, strung on pin type insulators, the following *empirical* formula is suggested:—

$$s = 0{\cdot}001\,E\,K = (kv)\,K \text{ inches} \quad \ldots \quad \ldots \quad (9)$$

where E = voltage between line-conductors
K = coefficient; from Table I (see below).

The values given in Table I are for single-phase lines and for equilateral triangular (delta) arrangement of the conductors of three-phase lines, with base of the delta on a horizontal plane (flat). Ice and sleet loadings are not taken into account. For equal sag and line voltage, add 25 per cent. to the coefficients where copper conductors are strung on suspension insulators. In cases where steel-aluminium conductors are used with pin-type insulators, add 20 per cent. to the values given in Table I.

TABLE I.

(E)* Standard Voltages.	s* = Sag of Conductor in feet.									
	2·4		6		8		10		12	
	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)
3,300-6,600	—	—	2·75	2·5	3·4	4·3	4·7	5·4	6·0	5·8
11,000	1·65	2·0	2·0	2·4	2·4	2·9	2·8	3·45	3·4	3·6
16,500	1·23	1·6	1·6	1·84	1·69	1·95	2·02	2·46	2·36	2·66
22,000	1·15	1·35	1·25	1·75	1·45	1·75	1·65	1·95	1·85	2·15
33,000	0·95	1·14	1·09	1·23	1·13	1·25	1·26	1·5	1·35	1·68
44,000	0·825	1·08	0·89	1·09	·975	1·18	1·08	1·28	1·16	1·38
55,000	0·76	0·95	0·82	1·0	·88	1·06	0·97	1·16	1·05	1·24
66,000	0·70	0·90	0·75	0·95	·82	1·0	·89	1·09	·967	1·14

* The *minimum* spacing of line conductors should ordinarily be based upon the maximum operating line-voltage (E), and the maximum sag (s) of the line-conductors, *i.e.*, for summer temperature conditions.

(*a*) is for copper conductors larger than No. 3 L.S.G.
(*b*) is for copper conductors smaller than No. 2 L.S.G.

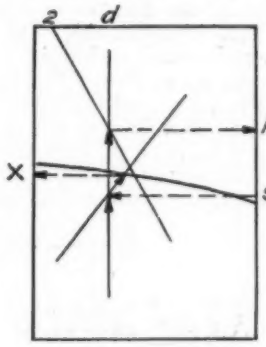
Example: It is desired to find the spacing for a 33,000-volt three-phase line with conductors arranged in delta form, *base of equilateral triangle* flat; conductor sag is 8·0 ft., and there are three No. 1/0 L.S.G. hard drawn copper wires strung on pin type insulators. From the *empirical* formula (9):—

$$s = 0{\cdot}001 \times 33{,}000 \times 1{\cdot}13 = 37{\cdot}3 \text{ inches.}$$

The deflection of the *all*-aluminium aerial conductor necessitates a larger spacing of the conductors; moreover a greater sag is required than for copper or for steel, aluminium conductors because of its lower tensile strength, and higher coefficient of expansion (see following table).

Conductor.	Coefficient of linear expansion.	
	°F.	°C.
Hard drawn copper	·0000093	·0000168
Aluminium cable	·00001286	·0000232
Steel-aluminium	·0000064	·0000115

This is objectionable in view of the fact that, among other reasons, experience indicates that conductors usually swing in synchronism on long spans and out of synchronism on short spans, and that, in general, it is possible to slightly decrease the spacing of conductors by something like 3 inches per 100 ft. increase in span above about 300 ft. Taken as a general rule, it is improbable that maximum winds will occur over every foot of long spans, but this cannot be said with equal certainty for short spans, which are more likely to be subjected to concentrated wind velocity, and usually the all-aluminium conductor calls for relatively short spans, and it may even demand a longer line-support—probably 15 per cent. longer.



To *find resistance*, follow size of Conductor *d* to intersection with *a—b*, or *1—4*, thence to scale of R on right.

To *find reactance*, follow line from S on right to meet size of Conductor *d*, thence pass along diagonal to intersection with X-line, and read value of X on left-hand scale.

Key to Chart II.

d = Size of conductor (vertical line) in L.S. gauge and sq. in. values.
R = Ohmic resistance, per mile of single conductor.
S = Spacing of *two* conductors, in inches between centres.
X = Inductive reactance in ohms, or reactance-volts per ampere, per mile of single conductor at 50 cycles per second.
2 = Conductor metal, for temperature value in °C. and °F. respectively.

(*To be continued.*)

Morse v. Broadcasting.

By M. S. MASON.

MUCH has been written, and more said, on the present relations of Morse to broadcasting. Some comments have been couched in words too strong for publication, and others, while expressing the views of a large number of people, have not dealt with the subject in such a way as to help to relieve the present situation.

It is the aim of the writer to deal fairly with both points of view, and, as no criticism is of use unless it is constructive, to try and point out a way to remove the present chaos.

To sum up the present position, broadcasting on 300 to 500 metres is becoming useless owing to the constant jamming of Morse stations.

When the P.M.G. first entered into agreements with the B.B.C. there is no doubt that the wave-lengths he then chose were thought at the time to be the best from both broadcasting and Morse points of view. We must remember, however, that wireless in those days had not recovered from the war restrictions that had been placed on it. Apart from shipping and Government stations, there was practically nothing doing on these wave-lengths. In fact, if one wanted to hear Morse, it was to higher wave-lengths that one tuned. The writer remembers listening on the memorable election night, when 2 ZY first commenced to broadcast in earnest, and although he was listening until between 2 and 3 a.m. not a single figure was missed, and he cannot remember hearing a Morse signal all night. But such is the state of affairs at the present time that many a strong word was said during the last election results, when several were completely jammed right out. The reason of this is quite apparent in the fact that the Morse stations, be they ships or land, have either considerably increased in number, or they have changed the time of their transmission to the evening.

One naturally gets "fed up," and the usual thing to do is to write to the B.B.C. a long letter of complaint. In reply the writer will receive a letter to the effect that the B.B.C. is continually bringing this matter before the P.M.G., but unless call sign and time are given, it can do very little. From other sources a reply may be given to the effect that most of the Morse is from ships, and as the safety of life depends on it, nothing can be done. The chief reason is the latter.

E

Going beneath the surface, one finds that the majority of ships are using very old apparatus and very flat tuning, with the consequence that they can be heard over a very wide wave band. Hence we arrive at a deadlock, to all intents and purposes; at least this is the impression formed by the decisions of the P.M.G.

Has broadcasting come to stay?

It is no good the P.M.G. or anybody else making a lot of alterations unless it has done so. My answer to the question is yes! and very emphatically. There are several reasons why it has come to stay, and should therefore be encouraged. First, it has brought pleasure into the lives of hundreds of thousands of people who were previously deprived of any enjoyable form of recreation, either through physical ailments or from the isolated locality in which they live.

Secondly, it is a means of education to people who, if asked to join a class of instruction would refuse, but they are, unconsciously in some cases, instructed nearly every night on some subject; thus helping to raise the standard of knowledge of the nation.

These are national reasons why broadcasting must stay, but what of the international?

The League of Nations is working hard to bring about a friendly spirit of goodwill between all the Governments of the world. What of the people themselves; what of the beings who through public opinion force the hands of the various Governments? Here broadcasting comes to the aid in a way that no League could possibly do.

Amateurs in this country and others in the United States are working together; the B.B.C. and U.S.A. are working together; France and the B.B.C. have worked together. The other night the B.B.C. sent a message to Scandinavia, and a gentleman of that nationality conducted the Royal Air Force Band for one item. Last, but not least, I heard the other night the *Petit Parisien* broadcasting in English, and asking English listeners to write and let them know what the transmission was like. Can this do any other than introduce the people of the various countries to each other, in such a way as to create the best of goodwill and friendliness?

This brings me to my point. All countries are faced, or will shortly be faced, with the broadcasting problem. What of the wave-lengths allowed? England, 300 to 500 metres; France, 450, 1,780, 2,600 metres; Switzerland, 1,100 metres; Belgium, 410, 1,100 metres; Holland, 1,070 metres; Madrid, 420 (about) metres; America, 100, 380 to 509 metres.

While 300 to 500 metres is fairly common, there is no method apparent in its choice. If this international reciprocation of programmes, or even our own, is to continue, something will have to be done, or, at the rate the Morse is increasing, it will soon be useless to listen. The best way, it seems to the writer, is that an International Committee be formed to decide on what wave-band broadcasting can conveniently be left to itself, and to restrict all Morse on that wave-band.

As regards our own broadcasting, either Morse or broadcasting will have to give way, and whichever it may be, a decision at once is necessary before more money is spent on either side. Nevertheless, as our country is partially surrounded by others, from which jamming may take place, the wisest course is to consult them and ascertain their views before coming to a decision.

To sum up, after allocating wave-lengths for business and safety purposes, out of 33,000 or so metres, surely a few hundred can be found by which the ordinary person may enjoy God's most wonderful gift.

Magnetic Separation.

Removing Combustible Matter from Ash and Separating Tramp Iron from Coal.

(COMMUNICATED.)

IT is, of course, well known that the ordinary ash as rejected from a boiler plant contains a certain amount of unburnt fuel, the quantity varying with the type of grate and the efficiency of combustion. As a result several devices for recovering combustible matter from ash have appeared on the market, and the results achieved by them indicate at once how wasteful is the ordinary process of combustion under boilers.

One of the most interesting and also one of the most effective of these fuel recovery processes is where the fuel and ash are divided by magnetic separation. This process is based on the fact that ash is attracted within highly concentrated magnetic fields, whereas coal and coke remain unaffected. All coals contain a certain amount of non-magnetic ferrous material, sometimes in a state of very fine distribution. This ferrous material is converted during combustion into magnetic iron compounds which pass into the clinker and ash, and make it susceptible to magnetic attraction. Further, it has been found that these magnetic iron compounds are concentrated in the ash in inverse proportion to the percentage content of ash in the fuel. Tests carried out on ordinary boiler refuse have shown that the recovery of coal and coke on an average exceeds 30 per cent. of the weight of crude ash; in some cases it is as much as 50 per cent., or even higher.

In one type of magnetic separator which has been used extensively on the Continent, and is gaining favour over here, the ash is fed on to the surface of a brass drum turning about a fixed magnetic field, the strength increasing from the top to the middle of the drum, and then decreasing until the weakest section is at the bottom. When the ash is fed to the drum the magnetic particles adhere to the surface, are drawn out of the path of the passing fuel, and are dropped underneath into a separate receptacle. The coal and coke, of course, pass straight on over the edge of the cylinder.

In most cases where this process is used it is advisable to screen the ashes on their way to the separator into two or more classes, which are then fed independently and separated.

The question whether the installation of such a separating plant will prove profitable depends chiefly on the amount of ash available, and the percentage of unburnt fuel which is normally rejected with the ash. In most cases such an installation will prove a good investment, and even in a small plant consuming a few tons of coal per day, a separator with a capacity of from 5 to 10 cwt. per hour will soon allow its initial cost to be written off.

Aside from the class of separation thus briefly discussed, magnetic separators may broadly be classed in three groups: First, where it is desired to remove tramp iron from coal or other material to be crushed; second, for concentrating minerals from their associated gangue; third, for removing iron from a finished product in order to improve its quality. At the moment we are concerned only with the separation of iron from coal which is to be fed direct to boilers or, more important, where it is first to be treated by crushers for pulverised fuel firing or for combustion on automatic stokers.

In spite of the early prejudice against their use, belt conveyors are coming more into use for feeding coal to boiler-house hoppers or to crushers, and the magnetic pulley when installed as the head drive pulley not only takes the place of the ordinary cast-iron pulley

commonly used, but it also makes possible a magnetic separation of unburnable or uncrushable materials at this point. As a general rule, magnetic pulleys are crowned, and are made wider than the belt running over them. In certain cases where the speed of the belt or the burden on it is excessive, an auxiliary short-centred complete magnetic pulley type separator with a wider belt is installed, upon which the coal from the conveyor belt is discharged.

There is, of course, a relationship between the diameter of the pulley and its magnetic strength. The limited space on the smaller pulley permits a corresponding reduction in the amount of steel and magnet wire used. It is thus evident that where belt speeds or quantities carried are high, pulleys of larger diameter should be installed.

In the separator of this type the coal passes along the conveyor belt towards the magnetic pulley which is installed as the head pulley at the point of discharge. On reaching the magnetic field, the iron and other magnetic material adheres to the belt and is pulled out of the flow of coal, to be discharged into a bin when the belt doubles underneath on its return run, and the iron is carried out of the magnetic field. A belt made of rubber, duck, or leather can be used, which, though they are insulators in the ordinary sense of the word, do not affect the magnetic flux. The speed of the conveyor belt may range from a picking belt running at 10 ft. per minute up to an ordinary conveying belt running at 500 ft. per minute. As a general rule, speeds of 150 to 250 ft. per minute give the best results.

In pulleys of the "high intensity" type the magnetic gaps and pole pieces are proportioned so that a long range can be obtained if it is necessary. On the other hand, where the belt load is small, or where very small pieces of iron are likely to be encountered, the gaps and pole pieces are proportioned to give a more evenly magnetised surface.

It is obvious that the total flux emanating from the surface of a magnetic pulley is the factor which determines its efficiency. Flux can only be obtained through the liberal use of magnet steel and copper wire, the proportion being correct. A given number of ampere-turns must have a sufficient amount of steel to conduct the flux produced by them in a given volume, and this is determined by the diameter and width of the pulley, the maximum strength being obtained by utilising the available space for steel and wire.

These magnetic pulleys are usually made in sizes from 12 to 48 in. in diameter, the shaft being of such dimensions that the magnetic pulley can easily be installed in place of the ordinary conveyor head pulley.

Magnets of this type are, of course, for continuous separation of iron from coal when the fuel is on its way to the boilers or crushers. There are also various other types in which the material is fed into a hopper feeding a vibrating shaker conveyor, the material then being conveyed under the magnets. In this type the magnets consist of a large stationary primary electromagnet, and a series of small secondary induced magnets mounted upon a revolving disk. The primary magnet is held solidly in a fixed position, and has heavy double coils and cores, with pole pieces projecting downward and conforming to the circle of the disk. The secondary magnets are inductively energised by the primary magnets when over the conveyor, but become demagnetised when they leave the proximity of the primary poles, and automatically discharge any iron or magnetic material, dropping it at the points where the disk overhangs the side of the conveyor, where it is conveyed by chutes into a receptacle below. This type of separator can be used for almost any purpose, and ranges in application between cattle and poultry food and mineral concentrates.

In another type of dry separator, the material flows from a hopper on to a feed roller which spreads it in a thin uniform layer over the whole width of the conveyor belt as it travels towards the poles of the magnetic system. This system consists of two horseshoe electromagnets arranged one above the other. The poles of the upper magnet are forged in the form of a sharp wedge, while the lower ones are flattened. The magnetic force of the upper pole is stronger than that of the lower, so that magnetic particles jump towards it. They are intercepted, however, by a cross-belt running between the poles at right angles, which removes them from the magnetic field and drops them into a bin below.

This type of separator is constructed with one, two or three double magnets, giving two, four or six poles, each double magnet having a rheostat for regulating the current strength. The use in this way of a series of magnets of different strengths permits the separation one from another of materials having different magnetic permeability, as well as the separation of the magnetic from the non-magnetic. The separate removal of the strongest as well as the weakest magnetic materials is thus obtainable. An instance of this is in the treatment of monazite sand, where magnetite is removed by the first magnet, ilmenite by the second, leaving the monazite to be extracted from the sand by the third magnet. Similarly, in the treatment of zinc blende and the tungsten minerals, it is generally necessary to remove fragments of crusher steel, magnetite, garnets, &c., by comparatively weak magnets before applying the strongest magnet to the recovery of the valuable and more weakly magnetic minerals.

In another type of magnetic separator a rubber belt travels very slowly in an upward direction over a large inclined magnetic table. The crushed material rolls down the table, but the magnetic particles are caught and carried upwards and are discharged into a bin.

Magnetic separation has been applied successfully to wet materials. In one such device the wet material is passed over a multi-pole electromagnet encased in a copper water-proof casing, above which is placed a removable brass tray. This tray is equipped with auxiliary magnets which are placed directly above the pole pieces of the electromagnet, the auxiliaries being inductively energised by the poles of the electromagnet, and holding effectively any magnetic particles passing with the flow. At the end of the day the current is released and the tray which holds the auxiliary magnets is taken out and washed. At the end of the tray a collapsible safety spout is arranged, so that when the current is released, the flow of wet material is automatically blocked, thus preventing any accumulation of iron on the auxiliary magnets from contaminating the wet substance which has already passed through it.

Magnetic separation is as yet only in its infancy, and its applications continue to be extended as the need for removal of iron and similar magnetic substances from varous industrial products becomes recognised.

Galvanised Steel Wire Strand for Signalling Purposes.—The British Engineering Standards Association has published a specification setting out the conditions governing the supply of 7/17 s.w.g. galvanised steel wire strand for signalling purposes; it includes a number of definitions and clauses relating to such matters as construction, material, dimensions, lay and inspection. With regard to galvanising, it is laid down that the zinc used shall contain not less than 97.75 per cent. pure zinc. These clauses are followed by particulars of the tests which the wire is required to pass, including the method of taking the test samples, twisting, elongation, and tensile tests, also dipping and coiling tests to prove the quality of the galvanising. The Specification concludes with directions as to coiling, marking, and packing of the accepted materials and a table giving the percentage elongation, breaking loads, &c., for 17 s.w.g. wires of various tensile strengths. Copies of this publication (No. 163-1924) are obtainable from the B.E.S.A. Publications Department, 28, Victoria Street, S.W.1, price 1s. 2d., post free.

Power of Loop Antennæ.—The amount of power received and developed by a small loop antenna radio receiving set has been calculated by Dr. W. R. Whitney, research chemist of the American General Electric Co. At the recent meeting of the American Chemical Society he said that a loop one foot in diameter, in receiving radio impulses at Schenectady from San Francisco, received such a minute amount of energy that the energy set free by a house-fly in climbing one inch up a wall would equal what was received day and night and for a continuous period of 35 years.—*Science Service.*

Protective Resistances and Fuses for Potential Transformers.

By C. A. WILSON.

POTENTIAL transformers are frequently responsible for serious breakdowns on high-pressure systems. When a surge takes places on the system, especially in the case of a large power supply, it may happen that the insulation of the h.p. windings of the potential transformers connected thereto is subjected to severe stress due to the high voltage induced between neighbouring turns. This voltage may even reach a momentary value of a hundred times the normal working voltage.

It thus often happens that the insulation breaks down and causes a short circuit either direct to earth or between phases.

If the defective transformer is not immediately cut out of circuit, the consequences may be very serious.

It has been found that no type of h.p. potential transformer fuse at present on the market is capable, by itself, of satisfactorily opening a heavy short circuit. Usually, when such a short does occur, the fuse is blown, but the current arcs over and the short persists with disastrous results.

Hence, in order to ensure that the fuses protecting the h.p. side of a potential transformer shall open the circuit immediately a short occurs, the possible short circuit current must be limited to a safe value by inserting a resistance in series with the fuse. This, however, tends to increase the phase angle and ratio error of the transformer, so that the value of the resistance used must be such as will allow the error to be kept within permissible limits.

If the transformer had no impedance, the phase angle and ratio error would be zero, so that if the effective impedance is increased by a small percentage by an additional resistance, then the phase angle and ratio error will only be increased by approximately the same percentage.

Taking the case of a single-phase transformer—

Let x = maximum permissible percentage increase in phase angle and ratio error.

p = percentage impedance of potential transformer.

z = impedance of potential transformer in ohms.

E = line voltage.

R = required resistance in series with fuses.

A = normal full-load current of transformer.

V_a = volt-ampere rating of transformer.

Then—

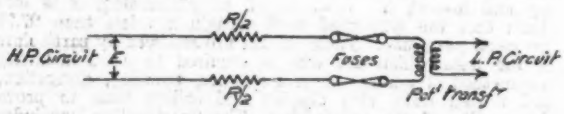
$$p = z_A \times 100/E = (z/E) \times (V_a/E) \times 100.$$

Therefore $z = pE^2/100\ V_a$ ohms.

Therefore maximum value of $R = (pE^2/100\ V_a) \times x/100.$

i.e., $R = x\ p\ E^2/V_a \times 10^4.$

Thus, for a single-phase circuit, a resistance of value R/2 ohms should be inserted in each line, as shown in the following diagram:—



For a three-phase circuit, the same formula holds, provided the potential transformer is star-connected and the voltage, E, is the line voltage (not the phase voltage). A resistance of R ohms should be inserted in each line.

To illustrate the use of this formula, take the case of a 6,600-volt, three-phase potential transformer (star-connected) rated at 150 VA and whose impedance is given as 1.2 per cent.

Now, if the maximum permissible increase in phase angle and ratio error is 10 per cent. (a usual figure), the required value of the protective resistance is—

$$R = 10 \times 1.2 \times (6{,}600)^2/10^4 \times 150.$$

$$= 348.5, \text{ say } 350 \text{ ohms.}$$

This will reduce the possible short-circuit current to—

$$6{,}600/\sqrt{3} \times 350 = 10.8 \text{ amperes.}$$

In practice it has been found that a 6,600-volt fuse will operate satisfactorily with a current of this value, rupturing the circuit in a fraction of a period. Hence, the value of the resistance as found above will effectively protect the transformers.

Parliamentary.

[By Our Special Parliamentary Reporter.]

Iron and Steel Trade.—On May 26th, Mr. D. C. SOMERVILLE asked the Parliamentary Secretary to the Overseas Trade Department, whether his latest returns threw any light on the ability or inability of British iron and steel constructional work to hold its own in non-British markets.

Mr. LUNN replied that he was aware that British iron and steel constructional work was at the present time meeting with severe competition in non-British markets. The Lord Privy Seal stated on May 22nd that the Government would institute an inquiry into matters of this kind; and he hoped that it would soon be possible to make a definite announcement on the subject.

Grampian Electricity Supply Bill.—On May 27th, this Bill was read a third time in the House of Commons.

Southern Railway Electrification.—On May 27th, Sir P. RICHARDSON asked the President of the Board of Trade when the tenders for £5,500,000 were called for by the Southern Railway Company in connection with electrification work guaranteed under the Trade Facilities Act; when the contracts in connection with this were let; and to what portion of the present Southern Railway system did this electrification apply?

Mr. H. GOSLING, who replied, said he understood that up to the present tenders had been called for and contracts placed at various dates for approximately £2,000,000 altogether. The electrification to which the hon. member referred applied to the South-Eastern and Chatham Section of the Southern Railway within a radius of about 15 miles from London.

Severn Barrage Scheme.—On May 27th, Mr. BAKER asked the President of the Board of Trade whether his department was at present considering the desirability of an investigation as to the economic feasibility of utilising the tides in the Severn for power purposes in accordance with the recommendation contained in the third interim Report of the Water Power Resources Committee; and how soon a decision was likely to be reported to the House.

Mr. S. WEBB said that the answer to the first part of the question was in the affirmative. Consideration of the matter was proceeding as expeditiously as possible, and he hoped that a decision might be reached at an early date.

Automatic Telephones.—On May 27th, Mr. HARTSHORN, Postmaster-General, informed Mr. MIDDLETON that twenty-two telephone exchanges were at present equipped with automatic apparatus, namely, Leeds, Portsmouth, Southampton, Blackburn, Accrington, Newport, Grimsby, Stockport, Paisley, Darlington, Epsom, Dudley, Hereford, Marton, Dundee, Broughty Ferry, Hurley, Ramsey, Chepstow, Fleetwood, Hadleigh and Blockley. Many of the automatic exchanges in operation were established in order to provide practical experience of the various types of automatic equipment. The exchanges were not selected primarily with a view to securing economy but efficiency. Although in most cases there had been some saving, comparative figures of annual charges on existing automatic exchanges would not serve any useful purpose. Taking, however, exchanges recently transferred, the annual saving at Dundee and Broughty Ferry, which formed a single group, was estimated at £4,000, and at Southampton £2,000.

Rugby Radio Station.—On May 27th, Mr. HARTSHORN informed Mr. Nicholson that the capital cost of the Rugby radio station with 12 masts, was estimated at about £400,000, including site and buildings. The addition of four more masts, as recommended by the Donald Committee, was estimated to cost £62,000. It was anticipated that the station would be capable of continuous commercial communication with Australia during the 24 hours of the day, except when the atmospheric conditions were particularly unfavourable, which might on the average be for two or three hours out of the 24.

Cables to Denmark.—On May 27th, Mr. BAKER asked the Postmaster-General whether a licence had recently been granted to a Danish company giving it a monopoly of telegraph traffic between Great Britain and the Scandinavian countries and Northern Russia.

Mr. HARTSHORN said that the question no doubt referred to the Great Northern Telegraph Company of Denmark. It had recently been agreed to extend this company's licence until the end of 1934, the preferential rights to unrouted traffic which the company had hitherto enjoyed being surrendered. The terms of the company's licence were similar to those granted to other companies which were permitted to land cables in this country.

Electricity and Unemployment.—On May 29th, during the resumed discussion on the Unionist motion to reduce the salary of the Minister of Labour, in order to call attention to the alleged failure of the Government to deal with unemployment, the Prime Minister referred to the steps the Government had taken with regard to electricity schemes. He said that the raw material for working out a great scheme for electrical supply was in two or three reports, mainly the report of the Haldane Coal Conservation Committee and the report of the Committee on the Utilisation of Water Resources. Under those reports a pretty steady development had already taken place. Of the 16 districts which the Haldane Committee recommended, which had now been reduced by the Williamson Committee to 15, nine had already been put into operation. But, he asked, could they solve the hydro-electric problem in four months? He believed that the development of electrical power was going to have a tremendously beneficial effect in steadying work under normal conditions and in increasing the efficiency of the country, and everything which the Government could do would be done. First, they must explore the water possibilities and the place for that exploration was Scotland. The Severn barrage scheme ought also to be considered. He complained that the Act of 1919 was based on a voluntary foundation, and said he thought that the Government might produce compulsory legislation in order that electrical development might be hastened.

After a lengthy discussion the Unionist amendment, tantamount to a vote of censure, was rejected by 300 votes to 252—Government majority 48.

The Rutenberg Concession.—On May 28th, in the House of Lords, Lord ARNOLD, Under Secretary for the Colonies, in reply to Lord RAGLAN, said that, with regard to the Rutenberg concession in Palestine, there were two concessions in question. A concession in connection with the supply of electrical energy in the district of Jaffa was already in force, and was held by the Jaffa Electric Company. The High Commissioner in Palestine had recently reported that this company was conducting its operations to the satisfaction of the consumers whom it supplied and that it was correctly adhering to the terms and conditions laid down in the concession. With regard to the works which had been constructed, a full report had been received from the High Commissioner. Jaffa and Tel Aviv were now provided with electrical energy for private and street lighting, water supply and industrial purposes. Petach Tikuan remained to be supplied, and would be supplied either from the existing fuel power house at Tel Aviv, or from the hydro-electric station on the river Auja. The existing power house contained two Diesel generating sets of 1,000 h.p. capacity. About 5 km. of high-pressure underground cables had been laid in Jaffa and Tel Aviv, transmitting energy to five sub-stations with transforming plant. A high-pressure transmission line 18 km. long was now being erected from the Jaffa power house to Surafend, and would serve a number of places in the southern part of the Jaffa district. The erection of a third Diesel generating set would shortly be completed.

The position with regard to the larger Jordan concession was somewhat different. Under the agreement with Mr. Rutenberg of September 21st, 1921, a concession was to be granted to a company with an authorised capital of not less than £1,000,000, of which not less than £200,000 was to be subscribed and paid for in cash, application for the grant of the concession being made within two years from the date of the agreement. Application was duly made within the time specified, and the Secretary of State had been satisfied that a company had been duly formed with the requisite authorised and paid-up capital. The actual issue of the concession had not yet been made, but he understood that it was on the point of being completed. In these circumstances, the Palestine Electric Corporation, to which the concession was to be granted, was not yet under any obligation to carry out the terms of the concession. As a matter of fact, however, a considerable amount of progress had been made, and the High Commissioner reported that he was satisfied with it. The engineering investigations into the works to be established on the River Jordan had been completed, and the plans required had been submitted to the Colonial Office, and, after reference to consulting engineers, had been approved. The Palestine Electric Corporation had been in no way responsible for any delay. He was informed that the cost of the first stage of the works was estimated at £750,000, of which about £300,000 represented the cost of machinery and materials required to be imported into Palestine. It was hoped that by far the greater part of these orders would be placed in this country. So far as he was aware, no compulsory powers had been exercised in connection either with the acquisition of land or installation of plant for any of the schemes in hand.

Special Orders.—On May 29th, Lord SALISBURY, in the House of Lords, in accordance with notice given, moved the appointment of a Select Committee to consider procedure with regard to legislation by Special Orders which require affirmative resolutions by both Houses of Parliament.—The motion was agreed to.

Yorkshire Electric Power Bill.—This Bill was read a second time in the House of Lords on May 29th.

L.M.S. Electrification.—On May 29th, Mr. W. GREENWOOD asked how the work of electrifying the railway between Manchester and Oldham on the London, Midland and Scottish Railway was progressing.

Mr. GOSLING, Minister of Transport, said he understood from the Railway Company that the specifications in connection with the electrification scheme referred to had not yet been completed.

"After-Hours" Shop-Window Lighting.

WHILE the value of a window illuminated after closing hours is recognised in the principal London shopping centres, in many of the large provincial towns little has been done in this direction.

The British Electrical Development Association has taken the matter up vigorously, and already much is being accomplished.

One of the latest towns to start an educational campaign among shopkeepers is Stoke-on-Trent, where the Electricity Department has recently arranged a shop-window display, an illustration of which appears herewith.

"After-hours" Shop Window Lighting at Stoke-on-Trent.

The dressing of the window has been carried out in three distinct styles by a local firm, and the electrical installation was designed by Mr. C. H. Yeaman (the borough electrical engineer) and Mr. Hainsworth, his commercial assistant.

The dimensions of the window are 16 ft. long, 10 ft. high, and 6 ft. deep, and it is equipped with three rows of 14-in. "Gecoray" reflectors, each provided with an "Osram" 100-W gasfilled lamp. The first row consists of 14 reflectors fitted with red, amber, blue, and green colour screens, each colour being separately switched. The second row consists of "daylight" lamps in two groups, while the third row of reflectors is fitted with clear lamps in three groups. At each end of the window separately switched spot and flood lights are fitted to enable any particular article to receive extra illumination. Two "Kingsway" revolving tables are placed in the centre and at one side of the window. For demonstration purposes a panel bearing the switchgear was placed at the side of the window. On this were mounted the Corporation cut-outs, two meters, a time switch, a change-over switch, tumbler switches, and a distribution board with fuses for each circuit. The time switch is arranged to give current between certain hours; this is separately metered and charged for at the low rate of 1d. per kWh. It is left to the shopkeeper to wind the clock mechanism of the switch, relieving the Corporation of the necessity of sending a man out for the purpose, and permitting short-period (and therefore cheaper) meters to be used.

Legal.

Installation Contract Dispute.

IN the Shoreditch County Court, on May 27th, before Mr. Registrar Kynaston, Mr. Alfred Beard, of Kingsland Road, E., an electrical contractor, sued Mr. Barry Green, of Penge, a traveller, to recover £3 10s., the balance of a contract for £15 10s., for fitting out the defendant's house with electric light. The defence was that he had not contracted with the plaintiff at all, but with Mr. J. Shapero, trading as the General Electric Engineering Co., and also that it was not completed.

The plaintiff gave evidence that he agreed to do the work for 14s. a point, and there were 16 points approximately. Also there were other things to do, which brought the contract to £15 10s. He received £5 and £3 in cash, and then a cheque for £5, which was stopped, and then the defendant commenced disputing the account.

The defendant said that through a friend of his he got in touch with Mr. Shapero, who agreed to do the work for £13 10s. He said he would send a man down to carry out the work, and Mr. Beard arrived. He paid him for labour and materials while the work was being carried out, with the idea of paying Shapero the balance. As to the stoppage of the cheque, it was because that when the work was supposed to have been finished the Electric Light Co. came in and failed to connect up. It had cost him a good deal of money to put the work right so as to get the electric light on. Mr. SHAPERO gave envidence, and denied that he contracted to do the work, and said what he did do was to agree to send down a man who would carry out the work at trade price, and this he had done. The REGISTRAR said he thought the plaintiff had made out his case, and gave a verdict for £3 10s. and costs.

Sequel to Tramway Accident.

AT the Bow County Court, on May 28th, Thomas Albert Wood, of Walthamstow, was awarded £150 damages for injuries in an action which he brought against the London County Council and the West Ham Corporation. On Christmas Eve last, while the plaintiff was riding in a tramcar at High Road, Leyton, the car left the rails, mounted the pavement, and struck a house. Wood was injured, and had since suffered from neurasthenia.—*The Times.*

Alleged Theft of Copper.

AT Wolverhampton Police Court, on May 8th, George Saunders, James Howell, and Harry Ashton, of Wolverhampton, were charged with stealing 16 cwt. of copper, valued at £49 10s., from the Wolverhampton Corporation power station between February 28th and April 30th. Only formal evidence of arrest was given, and they were remanded for a week.

Attorney-General v. Southport Corporation.

LORDS Cave, Dunedin, Atkinson, Shaw and Sumner on Friday afternoon delivered judgment in the House of Lords in the case the Mayor, &c., of Southport *v.* the Attorney-General and others, it being an appeal against an Order of the Court of Appeal declaring that the Corporation of Southport was not authorised or entitled to supply or distribute within the area formerly the Urban District of Birkdale, electrical energy for any public or private purposes whatsoever, including the lighting of public lamps, the Town Hall buildings, and the working of tramways. (See ELEC. REV., April 18th, p. 640.)

Mr. JUSTICE EVE gave judgment for the Corporation, but the Court of Appeal reversed his decision, so the Corporation appealed to the House of Lords. The appeal was dismissed, Lord Sumner dissenting. The majority of their lordships held that "supply" included, not only the distribution of energy among ordinary consumers, but also the provision of electric light and power for the Corporation's own use.

Halifax Corporation v. G. H. Willson and J. Richardson.

IN the Halifax Borough Court, on May 30th, G. H. Willson and J. Richardson were charged with unlawfully diverting electricity. Mr. Willson is governing director of Messrs. Smith, Barker & Willson, machine tool makers. It was stated for the Corporation that the company did the majority of their work by electricity. They had two supplies, for lighting and power, and, in addition, generated a supply for themselves. Inspections of the premises showed that for some time prior to January of this year very little, in fact, no electricity was used by the company for lighting. The matter was very fully gone into, correspondence passed, and eventually the Corporation confirmed the decision of the Electricity Committee to take proceedings. It transpired that Mr. Willson conducted the office work, and Mr. Richardson was shop manager. Neither had to do with the electricity. That work was done by an electrician who left the firm in April, 1920, and all alterations in the equipment were left in his hands. They had no knowledge whatever of what he did. The engineering industry had been very slack, so that no electrician had been appointed since the other left, and the apparatus was exactly as he left it.

Mr. W. M. ROGERSON, borough electrical engineer, gave evidence that the firm had no agreement at present with the Corporation, though one had ended on January 27th, 1923. He did not suggest that Mr. Willson personally knew what had been done. The premises were accessible to the Corporation officials, and he did not suggest there had been obstruction. No authority had been given to the firm to connect up to the power cable.

Mr. BENTLEY, for the Corporation, quoted instances where masters were held to be criminally responsible for acts by their servants.

The Bench decided that no *prima facie* case had been established, and dismissed the charge against Mr. Willson.

In the case against Mr. Richardson it was submitted that there was no evidence to substantiate the charge that Mr. Richardson, who was a perfectly reputable person, had any intention to defraud anybody.

The Bench said that the prosecution had not produced sufficient evidence to prove fraudulent use of the electricity, nor that the Corporation had suffered any loss. This case was also dismissed.

British Thomson-Houston Co., Ltd., v. British Insulated and Helsby Cables, Ltd.

JUDGMENT OF THE COURT OF APPEAL.

THE Court of Appeal, composed of the Master of the Rolls and Lords Justices Atkin and Sargant, on June 2nd delivered judgment in the case of the British Thomson-Houston Co., Ltd., against the British Insulated & Helsby Cables, Ltd., upon the defendants' appeal from the judgment of Mr. Justice Russell in the Chancery Division. The hearing of the appeal was reported in the ELECTRICAL REVIEW of March 31st, 1924, and the following issues.

Mr. Justice Russell held upon the evidence that there was sufficient subject matter to support the plaintiffs' patent and that the defendants had infringed, and he accordingly granted an injunction as claimed, and an inquiry as to damages, made an order for the delivery up of all infringing articles, and gave the plaintiffs the costs of the action.

The decision in this appeal will affect the result of a great number of other pending actions brought by the British Thomson-Houston Co. against other alleged infringers of their 1909 patent.

Their Lordships allowed the appeal, holding that there was no subject matter in the plaintiffs' 1909 patent, and entered judgment in favour of the defendants with costs of the appeal and in the Court below.

Sir DUNCAN KERLY, K.C., on behalf of the appellants, then applied for an order under their counterclaim for the revocation of the respondents' patent of 1909.

Sir ARTHUR COLEFAX, K.C., on behalf of the respondents, on technical grounds opposed the application for revocation, the main ground being that the appellants, when they launched their counterclaim, had not obtained the *fiat* of the Attorney-General.

At the conclusion of the arguments upon the point their Lordships held that the appellants' counterclaim for revocation was properly constituted, but made an order that the operation of that order should be stayed until an appeal by the British Thomson-Houston Company to the House of Lords had been heard.

Electricity in Agriculture in Italy.—Thirty years ago the possibility of using electricity in husbandry engaged public attention in Italy, but it is only during the last 10 years that experiments, shows, and prizes have been instituted with a view to popularising electricity among the agricultural community. According to the inquiries made by the Associazione Esercenti Imprese Elettriche and by the Cattedri Ambulanti di Agricoltura it is only since the electrical companies have taken the matter in hand that steps have been taken which will form a solid basis for the future. In general—except in mountainous districts or where the natural features are wholly exceptional—the possibilities and utility of electricity are everywhere admitted. Almost the whole valley of the Po River is served by electric installations, but in the rest of Italy such installations are the exceptions. This arises from the fact that electricity supply lines are very numerous in the north, but are rarer in the centre and the south. The most important applications of electricity are those for drainage and irrigation purposes; next the thrashing of wheat; then tilling; rice-drying; forage-pressing; cheese-making, &c.; chaff-cutting; olive-pressing; wine-making; milling and wood-sawing. The reclamation programme arranged for Venetia is of the first-class order. Electric tilling has been resorted to in these regions. The 333 agricultural subscribers consume about 10,000,000 kWh yearly, placing the Venetian companies in the foremost rank of those carrying out the agricultural programme. Among the various installations may be mentioned 132 drainage; 15 irrigation; 81 drying and treatment of cocoons; 36 thrashing and 5 tilling. Other installations are for cheese-making; raisin-pressing; distillation; forage-preparation; cleaning of grain; manufacture of manures, &c.—*Report of French Commercial Agent at Turin* per *l'Electricien.*

Some Notes on Increasing the Sales of Electricity.

By JULIAN G. THAIN.

It has often been a matter of surprise to the writer that in the practice of some borough electrical engineers the importance of increasing the sales of electricity appears to be insufficiently regarded, the more so because, primarily, an undertaking is, of course, run on a financial basis, and every Electricity Committee is naturally anxious to push business and exhibit a surplus to the rate-paying public.

A number of instances has come under his notice where engineers have had their enthusiasm kindled as the result of perusing an article in the technical Press, but after a longer or shorter period of energy, the interest in extending sales has gradually slackened in much the same manner as those CO_2 tests which were a feature of the routine in many boiler-houses a few years ago.

It is his intention to record in the following columns some hints gained whilst holding important positions in public supply undertakings.

The question of selling more electricity, and extending the area of operation, should occupy a foremost place in the brain of every chief engineer—the writer is, of course, alluding to public supply engineers.

There is sometimes, he thinks, a tendency in many power stations to devote attention to the reduction of generating costs almost to the exclusion of consideration of increasing sales. Such a policy is a real deterrent to maximum progress, and savours somewhat of *laissez faire*.

If the unit is being generated with 2.4 lb. of coal, there is really little to worry about. A good thing sells itself; besides, it is the contractor's business to look after his own interests! It is unfortunately true that this is the spirit which permeates more than one supply undertaking.

But are we not neglecting a profitable part of our duties as electrical engineers if we fail to pay the very necessary attention to the sales side of the undertaking—the basis on which so much of the financial structure rests?

The foundations of a house, of a shop, or factory are being laid down in the suburbs—do you know anything about this opportunity for doing business, Mr. Chief Engineer? Do your maps show you precisely where such a building or site is situated? Have you got in touch with the architect, the builder, the owner, and the prospective tenant? Do you know whether the owner desires to install gas or electricity?—or has the pushing gas manager forestalled you and canvassed him three months ago, and obtained his order? Do you leave such details to the contractor? and does he, in turn, leave it to you?

A little consideration will show that sales must come first every time, just as with any other commercial undertaking. Extensions and low generating costs will follow as a matter of course with modern plant and the present-day competence of technical staffs.

To increase the sales of energy, a definite scheme must be carefully planned and organised, throughout which the keenest, intelligent enthusiasm must permeate continuously—not spasmodically or superficially.

Men detailed for this class of work should be chosen for their natural aptitude and experience in this direction, where tact, discretion, and—above all—persistency, are blended with the one aim in view—to increase the sales of electricity.

We will imagine that a chief is about to organise such an intensive and continuous programme for pushing his business and increasing sales. He decides to card-index the whole town. Cards in correct alphabetical order for each street will contain the following details:—

Number of house in street.
Name of tenant.
Number of rooms.
If already wired for light and heat.
If gas is used, and for what purpose.
Changes of tenancy.
Number of pamphlet left.

Spaces are left for the inspector to fill in and initial, with date, each time he pays a visit, the object of which is to ascertain whether the consumer has any complaint to make with regard to the supply, &c., or if he wishes an extension to his existing installation.

Suggestions should be made that toasters, irons, vacuum cleaners, and other accessories can be lent to the consumer for a trial. All these details are also noted in a pocket book, together with the opinions of the consumer on installing such apparatus. At the end of the day these details are entered concisely on the cards and examined by the chief or his assistant.

It will often be found that after the consumer has been afforded the opportunity to try an accessory in his own house, he becomes convinced of its utility and saving of expense, and gives an order for it.

Where it is proposed to connect accessories using a comparatively large amount of current, it will be necessary thoroughly to examine and test the installation, and to take the precaution of strengthening all fuses likely to be affected. The fact that a fuse blows on connecting an iron for demonstration might perhaps deter some nervous individual from proceeding further in the matter.

It is, of course, advisable that arrangements should be made so that electricity used for such purposes is not charged for at lighting rates, as the extra cost would effectively frighten many from using such apparatus. In cases of this description an all-in tariff would smooth away many difficulties.

Once a consumer has installed his lighting service, he expects a similar, and often superior, service to that offered by the gas people, and the fact that to install a gas fire or oven necessitates the addition of an inexpensive pipe only in connection with the apparatus, and one meter that serves for both lighting and heating, is a point the moral of which many engineers of public undertakings would do well to investigate and take to heart.

The average consumer is inclined to be a trifle nervous of anything electrical, and bearing this in mind, it is wise to take every precaution against anyone inadvertently receiving an electric shock. Damp walls in cellars, kitchens, &c., are pronounced offenders in creating electrical osmosis on switches, fuses, &c.

All irons and other apparatus that are much handled must be effectively earthed, and only the best insulated flex should be used. A cheap flex soon frays and shorts, and is liable to cause severe burns on the hands. C.T.S. is far preferable for service and endurance to any flex of the cotton vulcanised kind, which never ought to be used for such purposes. It is here that our inspector—if he is thorough and conscientious—will apply his knowledge and protect the supply authority from the serious handicap of a bad name, and consequent loss of revenue.

As in any other business, a satisfied consumer is a paying proposition; he will often act as an enthusiastic canvasser, and be the means of inducing his or her friends to install similar apparatus. Hence the time spent by an inspector in periodically testing consumers' installations will have the effect of money well invested.

The writer has a vivid recollection of such a test revealing a dangerous earth in a consumer's cellar, and, no doubt, preventing serious damage.

If a fire can be traced to a "fused wire," the prominence given it in the Press does incalculable harm to the supply authority. It cannot be too strongly insisted on that a contractor must be carefully watched. When he has finished his contract, it is the engineer who has to supply that consumer and be the butt of complaints. A repair will provide work for the contractor, but it will also give the consumer reason to consider electricity unsatisfactory and costly. The best of contractors are liable to be the victims of unscrupulous wiremen.

The chief engineer may feel dubious as to the attitude of contractors towards the inauguration of such a scheme. In reality, however, the interests not only of the consumer and supply authority would be served, but also those of the contractors themselves, and they are, generally speaking, always ready to listen to reason and to co-operate.

There is a tendency to regard the position of meter inspectors as eminently suitable for raw youths. Personally, the writer is convinced that to employ such inexperienced individuals in this important work is an error of judgment which may quite easily cause loss of revenue as well as injure one's own good name.

The connecting link between consumer and engineer is the meter inspector, and the writer knows from personal experience what great harm may be effected by raw loquacious lads, as also by uncouth, ill-mannered men, when entering consumers' houses to read meters. Hence the necessity of engaging keen, intelligent, and mature men of good address, at a wage that will attract the right type. In this connection it may not be out of place to recall that large undertakings have appointed, and are appointing, combustion experts at salaries up to £500 per annum, for work that can be equally efficiently carried out by shift engineers, whose duties, moreover, it really embraces. On the other hand, a miserable pittance is offered to the man who has it in his power literally to make things hum on the financial side. Instead of combustion engineers, let us seriously get to work from the proper end, and appoint business-getters at a salary and commission calculated to attract those men one meets in commercial houses.

A sort of intelligence department should also form part of the general scheme, and men should be engaged who can get into personal contact with architects, builders, property and factory owners, and other large potential consumers. The personal equation will dictate when it is advisable to leave pamphlets, and to follow them up from time to time until the actual accessory is installed.

A consumer naturally wishes to know how much this or that accessory would cost per hour, and all such details must be memorised to enable an immediate reply to be made to a questioner.

A tactful salesman may often turn a rebuff to good account, where a man of less readiness would resent a snub. He knows from experience that if one hammers long enough the obstruction is bound, sooner or later, to give way.

Showrooms are all very well in their way, but here again there is a tendency for many to consider such a department as the alpha and omega of sales. Business needs to be diligently tracked out in these days of stern competition. It may come to you after years of grinding spade work, but in so far as selling electricity is concerned, the writer contends that it is not true business to sit in an office and look no further than to that portion which comes in of its own accord. The fact that we are in charge of a monopoly does not absolve us from the necessity and duty of straining every nerve and fibre to extend our sales. It is conceivable that were it otherwise, and were municipal supply authorities worked in active competition, the question of sales would always receive that attention which is necessary and greatly in evidence where business is competed for.

It is our bounden duty as electrical engineers to sell as much of our product as possible. We are not offering to the public an inferior article, but something that if only it is brought to the public, and demonstrated in the best possible manner, will prove a boon to every householder who has, up to the present, hesitated, probably for no other reason than the fact that no one has troubled or thought it worth while to bring to bear on him a keen business organisation built up on the lines indicated and suggested in this article.

Reviews.

Direct-current Dynamo and Motor Faults. By R. M. ARCHER. Pp. xii+204; figs. 75. London: Sir I. Pitman and Sons, Ltd. Price 7s. 6d. net.

In his preface the author compares the experimenter who tries to find out why a dynamo does not work properly to the doctor examining a patient. If this analogy be allowed we may liken this book to the quack medical encyclopædia which purports to prescribe for and to cure every ailment, real or imaginary, to which flesh is heir. Any text-book to be of assistance to "those in charge of electrical installations" should possess clarity and conciseness of expression, and, above all, it must be accurate. These qualities are, unfortunately, lacking here, while the actual information given could have with advantage occupied about one-quarter of the space. Where explanation at any length is attempted the result is often to introduce doubt and confusion in the reader's mind. No installation engineer needs to be told that it is possible to test a dynamo with "an artificial load rigged up by filling a large circular wooden trough (normally used for feeding sheep) with a solution of washing soda, and inserting electrodes made of rough galvanised iron from the roof of a shed." All but the most hardy might well hesitate ever to start, or even to use, an electric motor after reading the nine reasons why a motor may not start or the effects of a failure of the no-volt release of the starter "when the supply is turned on again."

In dealing with methods of starting, the risk incurred in leaving the field connected across the mains when the armature is open-circuited is emphasised by the statement that the induced e.m.f., when the switch is opened, "produces a surging to and fro of the electricity, and alternating P.D.'s are produced between the ends of the field windings." A little later, when using a resistance in the armature circuit for reducing the speed of a motor, this self-same risky connection is actually employed by the author. It will be a matter of surprise to engineers to read on page 106 that a break in an armature coil of a two-pole machine, when generating an e.m.f., results in the external current being halved, but when this coil comes under a brush the current in the main rises momentarily to double the value. Enough has been quoted to show that these inexcusable mistakes must seriously detract from any possible utility the book may possess as a treatise dealing with causes and treatment of common faults in d.c. machinery. Instead of helping those in difficulty it is more likely that reference to the book will in many cases make the poor reader more nervous than ever. The class of reader whom the book is intended to benefit really deserves something better than this.

A Manual of Fuel Economy. By CHARLES F. WADE, A.M.I.Mech.E., A.M.I.E.E. Pp. viii+144; figs. 40. The D.U. Technical Series. London: Chapman & Hall, Ltd. Price 9s. 6d. net.

The importance of economy in the use of fuel is being gradually realised in the various industries in which the combustion of coal or its products is essential for the generation of power or heat for various purposes. Apart from the question of national coal conservation, the recovery and maintenance of our overseas trade depends upon the adoption of the most efficient manufacturing methods, and directly or indirectly economy in the utilisation of fuel is of great importance in the various industries of this country.

Works managers and engineers are essentially busy men, particularly in these days of labour problems, and it is almost impossible to devote adequate attention to fuel economy matters, so that unless a specialist is attached to the staff dependence must be largely made upon the literature of the subject.

In putting forward a manual on fuel economy, the author realises the need for a practical handbook suitable for works engineers, and, without going deeply into the scientific aspects of the matter, he has endeavoured to give a clear exposition of the basic facts in connection with combustion and the efficient utilisation of fuels.

The principles of heat production and transference are clearly enunciated with regard to furnaces and boilers, and an important chapter follows on the subject of fuels.

Some useful information is given regarding coal and other fuels, but the notes on coke are rather meagre, for although both coke and coke breeze may be classified as low grade fuels, their use is very often justified for commercial reasons,

and one large power station in the London area alone consumes about 40,000 tons per annum of this class of fuel.

In regard to pulverised fuel the author instances the case of a works in Sheffield using about 250,000 tons of coal annually, and calculates that, with a 20 per cent. ash content, at least 50,000 tons of fine ash would be deposited over the neighbourhood every year. This estimate apparently assumes that all the ash in the fuel is ejected from the chimneys of the boilers or the furnaces, which, of course, is not true in practice.

The notes on coal sampling and testing are certainly very practical, but are rather lacking in detail where accurate results are of importance, and no fuel technologist is carried on the staff. Such details as the air-drying of the sample before grinding down and meshing through a 60-mesh sieve and the precautions that it is necessary to observe in the determination of volatile matter have been omitted, whilst the method suggested for the ash test is so refined, on the other hand, that considerable care in manipulation would be required to obtain accurate results. The analysis of fuels calls for a certain amount of training in chemistry if the results obtained are to have any real value, and it would be better in a work of this description either to give fully detailed instructions for testing or else leave the subject alone.

Calorimetry is practically confined to about three and a half pages descriptive of one particular make of calorimeter, and the chapter concludes with a note on the method of calculating the calorific value from the proximate analysis, although the formula given on page 38 appears to be erroneous. Goutal's formula in the correct form can only hold under certain conditions for British coals, and the results of its application to many coals are such that it is almost worthless as regards the valuation of the calorific value.

Chapter 4 is devoted to the combustion of fuels, and contains quite a lot of practical information of an elementary nature. In the remarks on page 39 on the combustion of carbon it is surely erroneous to bring hydrogen into the question at all when considering the simple reactions involved in the combustion of carbon as an element in either oxygen or air. As chemical symbols are used in the text it would be much clearer to give the simple formulæ for the reactions involved in the process of combustion. The statement that "with gaseous, liquid and pulverised fuel it is possible to mingle the fuel and air so intimately previously to ignition that combustion is rapid and complete with practically no excess of oxygen" is hardly true, even under laboratory conditions, and is apt to be misleading in a practical handbook.

Quite an interesting chapter is devoted to firing methods, and the author is able to give some really good practical notes on the subject. The remainder of the volume contains useful notes on such matters as brickwork, steam, feed water, waste heat utilisation, and metallurgical furnaces.

The concluding chapter emphasises the necessity of keeping records, and contains useful suggestions for collecting and checking the figures.

On the whole the book may be regarded as a practical volume, which will no doubt prove useful to works engineers or managers interested in the subject, although it cannot be recommended as a text book for technically-trained engineers or those specialising in fuel technology.

L. M. J.

Automatic Telephone Systems (Volume III). By WILLIAM AITKEN, M.I.E.E., A.Am.I.E.E. Pp. xiv+239; figs. 147. London: Ernest Benn, Ltd. Price 55s. net.

This is the third and concluding volume of Mr. Aitken's classical work on automatic telephony, and contains in all 71 sections, of which 14 deal with the Strowger director system (now being introduced by the British Post Office for London and other provincial areas), seven deal with the W.E. Co.'s panel system, three with the rotary system of Ericsson's, 11 with semi-automatics, and the remainder with miscellaneous automatic equipment.

As in the previous volumes, the tracing of the operations involved in the action of the various pieces of apparatus shown in the diagrams is greatly facilitated by a system of numbering corresponding to the successive operations described in the associated letterpress. The diagrams themselves are unique of their kind in that in several cases the author has been compelled, on account of their size, to provide pocket accommodation for them at the end of the volume.

With regard to the merits of the work as a whole, nothing can be added to what has already been said in the reviews of the previous volumes in these pages. The work is indispensable to the telephone engineer who has to keep abreast of the times in automatic developments. Large as it is, and comprehensive to a degree to which probably no other work of its kind can aspire, it, nevertheless, fails, as the author regretfully admits, to deal with the multitude of new designs which have been evolved by inventive ingenuity in recent years. The author, accordingly, has confined himself to the really important systems now in use, or about to be brought into use, ignoring those which are too complicated to be adequately dealt with in the present work, or "until some indication is given that they have advantages over established systems."

The publishers of these three volumes deserve a special word of commendation for the exceptionally fine quality of the work which they have produced.

Business Notes.

Bankruptcy Proceedings.—HORACE PEPLOW TUCKER, electrician, Empire Bungalow, Ellacombe, Torquay.—Bankrupt appeared in Exeter recently for his public examination. The liabilities due to 17 unsecured creditors were expected to rank at £401. The assets consisted of a life annuity of £52, estimated to produce £500, leaving a surplus of £99. Debtor attributed his failure to inexperience of business, underestimating the cost of work, and competition. He commenced business at Christmas, 1920, with a capital of £10. Prior to that, he had experience in electrical work with a motor company at Ilfracombe and at an electric theatre, and he had also assisted his father at Torquay. He had no complete record of his business takings and payments. He discontinued his business in November last because he could not carry on, and he handed it over to the foreman who was working for him, and he (debtor) became the latter's employé. The foreman paid him nothing for it, as there was nothing to take over, the only stock being what was required for work in hand, and the tools used by the foreman were his own. The principal work they had done in the business was wiring, and he had only kept sufficient stock to do immediate work. The whole of the furniture belonged to his wife, who purchased it before their marriage. At the date of the receiving order (April) he had about six judgments against him. He realised his insolvency after August last, but he continued trading because he hoped his father would assist him. His father died in November and left him the annuity mentioned in his statement. The examination was concluded.

T. A. THORNE, electrical engineer, 18, Lliedi Crescent, Llanelly.—Receiving order made May 23rd on debtor's own petition. First meeting, June 7th, at 4, Queen Street, Carmarthen. Public examination, June 17th, at the Guildhall, Carmarthen.

J. F. LYONS, electrical engineer, 25, Palmerston Street, and Front Street, Consett.—An order was made by the Board of Trade on May 23rd removing Mr. A. E. Carr, of 15, Grey Street, Newcastle-on-Tyne, from the office of trustee of the property of J. F. Lyons.

CHARLES JAMES TOMLIN, electrical engineer, Park View Gardens, Hendon, and Henrietta Street, Covent Garden, W.C. —A sitting of the London Bankruptcy Court was held last week before Mr. Registrar Mellor for this public examination. Particulars of the case recently appeared in these columns, the accounts showing liabilities £983 and assets "claim for director's fees from Tye Tyers, Ltd., £450," estimated to produce £22 10s. The examination was concluded.

D. H. GRIFFIN (Midland Electric Co.), 5, The Mart, St. David's Road, St. Annes-on-Sea.—Trustee, Mr. H. Parker, 11, Winckley Square, Preston, released May 23rd.

V. G. BURKITT (V. G. Burkitt & Co.), electrical engineer, 38, Park Road, Bristol.—Supplemental dividend of 2s. 5½d. in the £, payable at the Official Receiver's office, 26, Baldwin Street, Bristol.

L. A. BROWN, electrician, The Street, Frensham.—First and final dividend of 4½d. in the £, payable June 16th, at the Official Receiver's office, 29, Russell Square, W.C.

A. H. MILNES, electrical engineer, Glenside, Outlane, Huddersfield.—First and final dividend of 8½d. in the £, payable June 6th, at the Official Receiver's office, 12, Duke Street, Bradford.

L. KELSALL & H. KELSALL (KELSALL BROS.), electrical engineers, Castle Place, Maison Dieu Road, Dover.—Trustee, Mr. A. W. Whistler, 15, Bench Street, Dover, appointed May 23rd.

H. C. PERRY, building and electrical contractor, Birchfield Road, Headless Cross, Redditch.—First meeting, June 5th, at the Official Receiver's office, Ruskin Chambers, 191, Corporation Street, Birmingham.—Public examination, June 25th, at the Court House, Birmingham.

Bankruptcy Annulled.—J. BAKEWELL, electric light and power engineer, 43, Waterside Road, Barton-on-Humber.—Adjudication annulled May 22nd, all debts having been paid in full.

Company Liquidations.—KITCHING & MANTERFIELD, LTD., 4, Charles Street, and Cambridge Street, Sheffield, electrical contractors.—A meeting of the creditors of the above was held on May 26th at the offices of Messrs. Knox, Burbidge and

Co., chartered accountants, 45, Bank Street, Sheffield. The statement of affairs presented showed liabilities of £2,073, of which £1,440 was due to the trade and £633 to cash creditors. After allowing £57 for preferential claims, the assets were estimated to realise £2,333, or a surplus, so far as the creditors were concerned, of £261.

It was reported that the company was originally registered on August 1st, 1914, under the style of H. Kitching, Ltd., with a nominal capital of £1,500, divided into 100 preference shares and 200 ordinary shares, all of the face value of £5 each. The annual return showed that in 1923 the issued capital was £1,430. The company then removed to its present premises in Charles Street, and in the early part of the same year took up the manufacture of, and became dealers in, wireless goods. Last July Mr. J. C. Manterfield became a director, and in the following month the capital was increased to £2,500, while the name of the company was changed to Kitching & Manterfield, Ltd. Mr. Manterfield subscribed £600 in cash for shares. The balance-sheet, dated July 31st, 1923, showed a debit on the profit and loss account of £606. Since that date it was assumed that there had been a loss on the trading of £812, although detailed figures had not been prepared showing the trading. A resolution was passed confirming the voluntary liquidation of the company, with Mr. H. E. P. Beard as liquidator, while a committee was appointed, consisting of Mr. W. B. Gowers, Sheffield; and the representatives of the Sel-Ezi Wireless Supply Co., Ltd., London; and the Hallamshire Electric Co., Ltd., Sheffield.

Rogers, Foster & Howell, Ltd.—A petition for the winding up of this company has been presented to the County Court of Warwickshire, held at Birmingham, by the British Broadcasting Co., Ltd., of 2, Savoy Hill, Victoria Embankment, W.C., creditors, and will be heard in Birmingham on June 19th.

Arc and General Equipment, Ltd.—A meeting of members is called for July 1st at 37, Brown Street, Manchester, to hear an account of the winding-up from the liquidator, Mr. F. A. Gillies.

Waterloo Wireless Co., Ltd.—Winding up voluntarily. Liquidator, Mr. R. R. Bailey, 10, Dale Street, Liverpool. Meeting of creditors at the Liquidator's offices, June 11th.

Scarborough Tramways Co.—Particulars of claims to the Liquidator, Mr. H. W. Pulleyn, 8, Coppergate, York, by June 14th.

Electric Welding Co., Ltd.—A meeting of members is called for July 1st, at 28, Basinghall Street, to hear an account of the winding up from the Liquidator, Mr. E. Hayes.

Newington Electrical Co., Ltd.—A meeting of members is called for July 31st, at 14, Dale Street, Liverpool, to hear an account of the winding up from the Liquidators, Messrs. P. S. Booth and D. Bell.

British Radio Sales Co., Ltd.—First meeting of creditors and contributories held June 4th, at Carey Street, W.C.

Dissolutions of Partnership.—Varley Radio Co., 178, Ancona Road, Plumstead.—Mr. F. C. Varley and Mr. J. A. Refoy have dissolved partnership. Mr. Refoy will attend to debts and continue the business.

Martin & Mitchell, electrical contractors, &c., 70 & 71, Coventry Street, Kidderminster.—Mr. W. W. Martin and Mr. J. A. Mitchell have dissolved partnership. Mr. Mitchell will attend to debts and carry on the business in his own name.

Trade Announcements.—Following upon the retirement of Mr. Stanley Williams, the business of the Acme Electrical Co., of 250, Stanley Road, Bootle, Liverpool, will be continued under the same style by Mr. William Grant Lacey.

The Receiver and Manager of Jennings, Ltd., Bristol, announces that he has disposed of the Earlsmead Joinery Works, Pennywell Road, to a small syndicate, including the Jennings family.

Messrs. Long & Crawford, Ltd., of West Gorton, Manchester, have appointed Mr. G. W. P. Higginbotham, of 52, Bewick Road, Gateshead-on-Tyne (late of Messrs. A. Reyrolle and Co. and Messrs. Ferguson, Pailin, Ltd.), as their representative for the North-Eastern counties. His headquarters are at Newcastle.

The Electrical Trades Supply, Ltd., who have been established at Great Charles Street, Birmingham, for 24 years, have now moved to larger premises in the same street, but no change in the address is involved.

Mrs. Joseph Shaw announces that she is continuing the electrical business at 112, Hillgate Street, Hurst Brook, Ashton-under-Lyne.

Messrs. J. Fletcher & Co., electrical engineers, of Newgate Street, Worksop, announce that they are giving up the business.

Messrs. Matthews & Lewis, electricians, 41, Mill Road, Cambridge, wish to receive trade catalogues and lists of electrical and wireless manufactures.

Catalogues and Lists.—Messrs. Johnson & Phillips, Ltd., Charlton, S.E.7.—A small illustrated booklet setting forth the advantages of the "J. & P." wiring system.

Siemens & English Electric Lamp Co., Ltd., 38-39, Upper Thames Street, E.C.4.—Price List No. 68 illustrating numerous patterns of majolica fittings for ship lighting. Price List No. 69, containing particulars, illustrations, and prices of electric fans of several patterns. Monthly price list for June, of lamps, fittings, domestic, and other appliances.

Engineering Supplies, Ltd., 155a, Upper Thames Street, E.C.4.—A price list of varnished cotton and silk insulated tubing or sleeving.

The General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.—"The Osram G.E.C. Bulletin," a little journal devoted to various phases of "Osram" lamp production, sale, and use. A well illustrated catalogue dealing with Fraser and Chalmers conveyors, transporters, coaling plant, and other machinery for the handling of materials.

Sir W. G. Armstrong, Whitworth & Co., Ltd., 8, Great George Street, S.W.1.—A well-illustrated catalogue of country house lighting plant of several patterns. Also an instruction book for the assistance of operators or owners of these lighting sets.

The Steam Fittings Co., Ltd., West Drayton, Middlesex.—An illustrated and priced pamphlet describing self-contained thermo-electric quick-break switches.

Messrs. Ferguson, Pailin, Ltd., Higher Openshaw, Manchester.—Catalogue Sections No. 34, S1, oil-immersed circuit breakers, "Type U"; No. 46, S1, remote control for oil-immersed circuit breakers; and No. 66, S4, heavy-duty isolating switches. All three sections are fully illustrated.

Messrs. Marelli & Co., Ltd., 19-20, Garlick Hill, Queen Victoria Street, E.C.4.—Catalogue L. 7/4, containing prices and illustrations of fans of various patterns.

Messrs. Siemens Bros. & Co., Ltd., Woolwich, S.E.18.—Pamphlet 500 A—a list of public and private automatic telephone exchanges which have been made and supplied by the company. Also Catalogue 640, giving revised prices of dry cells and batteries.

Electrical Utilities, Ltd., Tudor Works, Park Royal, N.W.10.—Export Leaflet, April, 1924, describing "Utility" current limiters, cooker radiators, "Tudor" fires, &c. Illustrated and priced.

Messrs. Crossley Bros., Ltd., Openshaw, Manchester.—Publications No. 2,369, describing the company's exhibits at Wembley; No. 2,339, dealing with a new type of two-stroke crude oil engine; and No. 2,291, describing "Crossley" gas engines and suction gas plants.

The "Ceag" Miners' Supply Co., Ltd., Queen's Road, Barnsley.—An illustrated booklet dealing with miners' lamps in general and the "Ceag" electric safety lamp in particular.

Messrs. Ferranti, Ltd., Hollinwood, Lancs.—List We 3, illustrating and describing a patent intervalve radio transformer and a showcard advertising this.

The J. W. Buck Switch Co., 39, Victoria Street, S.W.1.—An illustrated and priced catalogue of tumbler switches with a rotary action.

Messrs. Bastian & Allen, 58, Haymarket, S.W.1.—Two illustrated pamphlets dealing respectively with a new type of baker's oven and "Bastian" geysers.

Messrs. Long & Crawford, Ltd., 2, Gorton Road, West Gorton, Manchester.—Eight-page pamphlet giving prices and illustrations of their switchboards, switchgear, and accessories.

Switchgear & Cowans, Ltd., Elsinore Road, Old Trafford, Manchester.—Descriptive Section No. 3-1, describing portable, flame-proof, three-phase, automatic oil-immersed safety gate end switches with earth circuit protection.

Messrs. Henry Joseph & Co., Ltd., 96 and 100, Victoria Street, S.W.1.—Trade price lists of electrical materials and accessories, and porcelain fittings.

The Mullard Radio Valve Co., Ltd., Nightingale Lane, Balham, S.W.12.—List No. V.A.3, giving details and prices of low-temperature filament amplifying valves.

Swedish Industries Fair.—A Swedish Industries Fair is shortly to be held in Gothenburg, at which all branches of Swedish industry will be fully represented. The Gothenburg Fair is the only official national fair and has the support of all the great commercial and industrial organisations of the country, each of which has established its information bureau. Interpreters will be available gratis, and careful arrangements have been made for providing suitable accommodation at reasonable prices, for visitors. In addition to staple products the main groups of exhibits include machinery and tools, metal products, sporting articles, heating, lighting and sanitary appliances, electrical apparatus and machinery, glass and porcelain, textiles, arts and crafts, scientific instruments, chemicals, foodstuffs, &c. The Fair will be open from August 4th to 10th.

Recent Contracts.—The Westinghouse Brake & Saxby Signal Co., Ltd., have recently obtained orders, through the Metropolitan-Vickers Electrical Co., Ltd., for 303 motor-driven air compressors, in connection with the electrification of the Southern Railway. They have also received orders from the London Electric railways for 69 motor-driven air compressors.

M. & P. Power-house Auxiliaries.—We have received from Messrs. Mather & Platt, Ltd., Park Works, Manchester, an attractively illustrated brochure commemorating their work in power-house auxiliaries at Barton power station, which supplies the city of Manchester and the South-East Lancashire Electricity District, and at other great power stations. Their work in condenser, boiler feed, and extraction pumps is dealt with, together with electrical auxiliaries from motors to rotary converters. A copy of this publication will be sent by the company to all responsible engineers who are interested.

British Empire Exhibition Notes.—The programme of the first conference of engineering societies, which has been arranged for to-day (Friday) by the Society of Engineers includes short papers and discussions on "The Channel Tunnel," by Mr. E. Benedict, M.Inst.C.E., and Mr. E. J. Flight; "Sanitation and Water and Gas Supply at the British Empire Exhibition," by Mr. R. Freeman-Matthews; "Pumping in Relation to Irrigation," by Mr. A. Honeysett, M.Inst.C.E.; and "Surveying and Pioneer Roadwork in West Africa," by Mr. G. V. Mathieson.

The D.P. Battery Co., Ltd., informs us that all of the 20 "Railodok" passenger cars which tour the grounds of the Exhibition are fitted with "Kathanode" batteries. These batteries are also used in the electric locomotive in the coal mine and in connection with a number of exhibitors' displays. There will shortly be no less than 4,400 "D.P." traction cells in active operation at the Exhibition.

The British Electrical Development Association has published a booklet ("Electricity in Service," E.D.A. No. 451) describing its exhibits at Wembley. The description is succinct and is accompanied by a number of excellent photographic reproductions.

Last week the employés of Mr. John Walsh, electrical engineer, Blackburn, visited the British Empire Exhibition at Wembley for their annual picnic, Mr. Walsh defraying all expenses.

A new attendance record was created on Saturday, May 31st, when the number of visitors reached a total of 169,202.

Threatened Strike of Railway Shopmen.—What was described as an "unofficial" strike was threatened by railway shopmen on the London Electric and Great Western Railways at midnight on Wednesday. Demands were put forward for 10s. advance on wages, with a minimum of £3; consolidation of the existing war wage of 16s. 6d.; and other demands related to holidays, &c. The 10s. application was to cover all men in the power departments who were covered by Awards Nos. 728 and 648.

The Trade Position in Turkey.—At the annual meeting of the British Chamber of Commerce of Turkey and the Balkan States, held at Constantinople on May 1st, Mr. Walter Seager, the chairman, said that at the close of their first year, without the protection afforded by the capitulations, their traders had been able to "carry on," and no flagrant abuse of power had been brought to their notice. The laws of the Republic had been applied in such a manner as to have allowed all legitimate trade to continue as heretofore. Isolated cases of regulations being wrongly interpreted by local officials had been reported, but had been righted on reference to the Central Government at Angora. One constructive proposal had been adopted during the year. A closer relation between the foreign Chambers of Commerce and the Constantinople Chamber of Commerce and Industry was felt to be desirable, and, on the initiative taken by their Chamber, a proposal for close co-operation with their Turkish colleagues was made to the American, French, and Italian Chambers. It was unanimously agreed that a body be appointed consisting of representatives of the foreign Chambers and delegates nominated by the Constantinople Chamber of Commerce and Industry, to which matters of common commercial interest might be submitted for discussion and, if necessary, for action to be taken by the Constantinople Chamber of Commerce and Industry with the Government of the Republic. This body is at present in process of formation, and it is hoped that in the course of time it would constitute an institution capable of rendering very valuable assistance to the foreign commerce of Turkey. Mr. Seager, in referring to another constructive proposal, said:—"The Turks, like ourselves, labour under the disadvantage of being meek, or, if you prefer it, too profoundly convinced of the justice of their cause to advertise their case. All Turkish questions suffer from the lack of propaganda—the Turkish case is never adequately presented to our public at home, and Turkey's credit suffers accordingly. The suggestion is that all of us who are interested in British trade in Turkey should take pains to understand and advertise the Turkish point of view in all questions bearing on the trade and credit of this country. In this respect, in helping the Turks where they most need assistance we shall be helping ourselves. Advertisement, however uncongenial it may be to some temperaments, is to-day a vital necessity to all successful trading."

The annual report of the Council stated:—"With the removal of the great obstacle to commercial intercourse between our two countries, our traders must not imagine that business will come to them without having to face vigorous and systematic commercial competition. Any attempt at aloofness or disinterestedness on their part in this market will undoubtedly redound to their own disadvantage in the future. Business at the present moment may be difficult, nevertheless, business is being done on safe terms, and it is just when a market is difficult that it requires the most care. A 'wait and see' policy, as advocated in a section of the London Press recently, will only be playing into the hands of our commercial rivals."

Machine Tool and Engineering Exhibition.—In connection with this exhibition, which is to be held at Olympia from September 5th to 27th, the Machine Tool Trades Association has issued a list of members and a chart of their products, which forms a useful work of reference. The Association has also published a preliminary list of exhibitors.

Proposed Russian Fair.—At a meeting of representatives of Government and economic organisations called by the regional Chamber of Commerce, it was decided that a trade and industrial fair should be organised in Leningrad. The time proposed is towards the end of the present year.—*Reuter's Trade Service* (Moscow).

For Sale.—The L.C.C. invites tenders for the purchase and removal of a 5,000-kW turbo-alternator, with condensing plant and other auxiliaries, and also eight motor generators at present in the Council's sub-stations. (See our advertisement pages to-day.)

Dudley Board of Guardians invites offers for one 22-b.h.p. Marshall steam engine coupled to 250-V dynamo. See our advertisement pages to-day.

Epidemic of Failures in Germany.—The Berlin correspondent of the *Manchester Guardian Commercial* says:—"Bankers, traders, and industrialists are feeling an unprecedented shortness of liquid assets, and the slow pace at which payments are coming in is upsetting all arrangements. Hardly anyone can pay up, and even those who can, hesitate to do so, as they have no idea when their own outstanding accounts will be settled. Countless bills are being protested or have to be taken up by the banks on behalf of their clients. There are large banking houses in consequence which no longer have sufficient funds to pay out amounts of £50 to £100. There is no end to the failures, though, so far, they have virtually all been among post-war firms. This week, however, an important West German firm of world-wide repute, Edelstahlwerk Becker A.G., of Whittlig, has come to grief. It owned a number of coal mines in addition to its steelworks. There is a tendency to fear that other important West German enterprises will be unable to hold on much longer; at all events, the creditor firms of the Becker works are sure to be seriously affected. This week the wildest rumours were current on 'Change of further impending failures, but they proved groundless. On the other hand, a whole series of important and financially strong concerns have decided, either from shortage of orders or of available capital, to restrict production or close down their works. It is impossible yet to hazard an estimate of the extent to which concerns are failing, as most are able, at all events for the time being, to avoid a declaration of bankruptcy by placing themselves under official supervision, in other words, by demanding a sort of private moratorium, under which creditors are put off for an indefinite period while the debtor firm is enabled to continue in business. This arrangement is scandalous, since there is not any official publication, up to the present, of the names of the firms under supervision. The result is an extraordinary development of lack of confidence and an exaggerated pessimism among all creditors."

Tramway Employés' Wages.—Last week, the Manchester Tramways Committee received a direct application from its employés for an all-round advance of 8s. a week. Originally both Manchester and Salford tramwaymen were united in the proposal for a direct application to the respective tramway committees, but subsequently the Salford men merged their case into the national application. Manchester employés number more than 3,000 men, and the Salford system employs nearly 2,000. The Manchester Tramways Committee has also received, through the Joint Industrial Council, the national application for a 6s. a week advance.

The application of the Transport and General Workers' Union for increased wages, stabilisation of wages, and higher rates for night work for its tramway members was considered by the Joint Industrial Council for the Tramways Industry on May 28th. At the meeting the employés' three months' notice to terminate the existing agreement was formally accepted; this will accordingly come to an end on August 16th. The employers asked for two or three weeks' adjournment to enable them to ascertain the effects of the men's claim. The meeting was therefore adjourned, and, according to Mr. J. Cliff, the secretary of the Union, it will be resumed shortly after Whitsun. An endeavour is being made to associate the Scottish undertakings with the claim to make it general in its application.

The Argentine Electrical Trade.—In the course of a note upon the market for electrical supplies in Argentina, *Commerce Reports* states that competition from European electrical manufacturers who formerly held the Argentine trade is beginning to return, some of the concerns being engaged in vigorous sales campaigns. Their gain, however, is confined to the smaller and cheaper electrical lines, the Americans having been successful in maintaining the lead on all heavier equipment. In appliance lines this competition is perhaps the most noticeable, due to the lower production costs of European manufactures. Advantage is also taken of the natural tendency of the German and Italian elements of the Argentine population to prefer goods made in their respective home countries.

"The Electrical Alphabet."—This is the title of an illustrated booklet which has been produced by the West Ham Electricity Department, for the edification of prospective consumers. After the style of "A was an apple-pie," the "Alphabet" gives sage advice and illuminating information in couplets, illustrated with telling sketches by the staff humorist. Of course, "E exactly expresses Electricity—Effects economy, establishes efficiency." This kind of propaganda is effective; we were led on till we found we had read it all.

Leipzig Autumn Fair.—The Autumn Fair is to be held at Leipzig from August 31st to September 6th. A new exhibition hall for heavy machinery will be brought into service, also a new underground hall. The Russian Government has taken space, and invitations have been extended to the British Dominions and Colonies.

Lamp Cap Manufacture.—A correspondent states that the British Thomson-Houston Co., Ltd., and the Osram Electric Lamp Co., Ltd., are erecting a new factory at Chesterfield for the purpose of making caps for electric bulbs. Our correspondent hints at extensions in connection with the manufacture of electric glassware at Chesterfield.

Automatic Telephones for Japan.—The contract for the reconstruction of the Tokio telephone system, which was utterly destroyed in the recent earthquake, has been awarded to the Nippon Electric Co., Ltd., of Tokio, an associate company of the Western Electric Co. The entire system is to be of the Strowger automatic type, and will be manufactured in England jointly by the Western Electric Co., Ltd., of London, and the Automatic Telephone Manufacturing Co., Ltd., of Liverpool. The initial order covers an equipment of 25,000 subscribers' lines to be installed in five offices, with trunking equipment in two other offices to enable the subscribers on the new automatic exchanges to reach the subscribers on the remaining existing manual exchanges. The value of the initial contract now placed is about £750,000, and the entire reconstruction programme will involve the building of about 25 new exchanges in due course.

Book Notices.—"Annali delle Utilizzazioni delle Acque." Vol. I, 1924; part 1. Pp. 250; illustrated. Rome: Tipographia del Senato. Price 40 lire.—Following the publication of five volumes entitled "Annali del Consiglio Superiore delle Acque" (which council was disbanded in February, 1923), the Ministry of Public Works has authorised the issue of a new series of papers and reports, of which this is the first part to appear. Italy, since the days of those most competent engineers, the Romans, has ever been famed for the excellence of her hydraulic works, and the necessity of electrical power to meet modern needs, in the absence of native coal and oil, has spurred her engineers on to the development of her natural resources in the form of water power. Hence there are few, if any, countries whence more is to be learnt on this subject than from Italy, and the publication of the *Annali* will be welcomed by engineers in other countries which have awakened to the enormous value of their waterfalls under present-day conditions. The book before us contains a highly technical article on "lakes and derivations" by Luigi Kambo, and a table of the whole of the dams and reservoirs built or building in Italy in 1923, with heights and volumes, occupies 30 pages. Following these are 38 excellent photographic views of dams and reservoirs, complete or in course of construction, from which the economy of material and skill in design which characterise modern practice may be observed. A short article on the multiple-arch dam on the Gleno river, whereby 4½ million tons of water are impounded, is accompanied by 13 plates of drawings and photographs; this dam failed on December 1st last year, and some 400 fatalities resulted. Most of the remaining space is occupied by official information regarding legislation in Italy on water-power, and statistics.

A special issue of the "Keramische Rundschau" (No. 19, May 8th, 1924), of Berlin, has been devoted to "Elektro-Keramik"—the uses of earthenware in electrotechnics; it contains articles on porcelain as an insulating material, the manufacture of porcelain, the development of the overhead line insulator, the use of porcelain in the construction of high-pressure installations, testing porcelain insulators, mechanical data, cementing porcelain, stoneware as an insulating material, steatite, the life of porcelain insulators, &c., by specialists, together with other matter pertaining to the subject, and should prove useful to those interested in insulator problems.

"Jahrbuch der Elektrotechnik." Edited by Dr. Karl Strecker. Eleventh year (1922). Pp. viii + 241. Munich: R. Oldenbourg. Price 10 gold marks.—In this volume the electro-technical literature of the world, appearing in the year 1922, is briefly abstracted, under four main heads and 18 subdivisions. Some 180 periodicals have been examined for this purpose. The mode of treatment is to group under a sub-head very concise indications of the scope of each article bearing on that subject, together with an abbreviated reference to the part of the particular journal in which the article appeared. Thus under "Rectifiers, Electromagnets, Transformers," there are found "Mechanical Rectifiers" (which include "rotary converters"); "Static Rectifiers" (including "mercury rectifiers," "electronic valves and other stationary frequency transformers"); and "Transformers," including "textbook," "theory," "calculation," "operation," "construction," "electromagnets," the whole section occupying 8½ pages of text. An alphabetical author index, and a subject index, are provided.

We have received a copy of the "F.B.I. Year Book and Register of British Manufactures for the year 1924." It is published for the Federation of British Industries by the Industrial Publicity Service, Ltd., and has been edited by Mr. W. S. Barclay, F.R.G.S., and Mr. E. A. Nash, A.I.E.E. It opens with a general survey of the organisation and activities of the F.B.I.; a classified list of manufactures and products of its firms and associations is given in alphabetical order as to firm; a section follows giving all members' names in alphabetical order, together with their head office and works addresses, as well as the names and addresses of their agents overseas; and a bulky section of advertisements completes the contents.

"The *Journal* of the Municipal College of Technology," Manchester. Vol. XI (119 pp.). Manchester: The Education Committee.—This is the first account of researches at the College since 1916. Owing to this a great deal of work is described and it has been necessary to deal with it in the form of brief abstracts grouped under the heads of mechanical engineering, sanitary engineering, applied chemistry, textile industries, and mathematics.

"Elimination of Waste: Files and Rasps" (8 pp.). Washington: Government Printing Office. Price 5 cents.—This is one of a number of pamphlets on waste elimination prepared by the United States Department of Commerce (Bureau of Standards). The pamphlet aims at reducing the number of varieties, sizes, and types of files and rasps, and sets out a schedule of patterns agreed upon by numerous manufacturers and users.

"Science Abstracts." A. and B. Vol. XXVII. Part 5. May 25th, 1924. No. 317. London: E. & F. N. Spon, Ltd. Price 3s. each.

Marconi's Wireless Telegraph Co., Ltd., has issued a new booklet describing the wireless telegraph services "Via Marconi" between Great Britain and other European countries, Canada, the United States of America, and other parts of the world. It aims at satisfying the interest of the public in general, and of business men in this branch of wireless. It has therefore been written in popular language, and illustrated. The Baynard Press is responsible for the design, and the drawings and folding plan are by Aldo Cosomati.

The *Transactions* of the South African Institute of Electrical Engineers. March, 1924. Johannesburg: The Institute. Price 2s.—This issue contains a discussion on "Pulverised Coal as a Fuel in Practice"; a paper on "The Testing of Steam Turbines," by V. Pickles, M.I.E.E.; a discussion on various radio matters, &c.

The Sydney Electrical Contracts.—In the matter of a contract for electrical equipment involving an expenditure of over £12,000, the City Council on April 15th, by a majority of 12 votes to 8, decided to give the Lord Mayor power to negotiate with the English manufacturers for the supply of this material direct, and not through the English Electric Co., of Sydney, the local agents, on the ground that the English Electric Co. was involved in the inquiry that was proceeding into the procedure of certain companies.—*Sydney Morning Herald.*

Electricity Supply Rifle League.—A prize meeting was held on the ranges of the Hackney Electric Rifle Club on May 24th. The following are the results of the competitions:—25 yards: Mr. W. C. Young (Central Co.), 99. Handicap: Mr. A. E. Northrop (Central Co.), 98. Pool: Mr. A. E. Northrop, 100. 50 yards: Mr. W. Baines (City Co.), 100. Handicap: Mr. W. A. Lumley (Central Co.), 99, 33. Pool: Mr. W. C. Wright (Central Co.), 97. 75 yards: Mr. F. Smith (Central Co.), 98. Pool: Mr. W. A. Lumley (Central Co.), 98. Championship: Mr. W. Baines (City Co.), 293.

Trade with Germany.—Mr. C. J. Kavanagh, Commercial Secretary in Occupied Germany, resident in Cologne, is at present in attendance at the Department of Overseas Trade in London, and between now and June 13th he will be pleased to interview British manufacturers and merchants interested in export trade to Occupied Territory of Germany. Communications should be sent at once to the Comptroller-General, Department of Overseas Trade, 35, Old Queen Street, London, S.W.1 (reference T.G. 5358).

The Building Trade.—The result of the ballot of the building trade was 68,967 for acceptance of the terms offered by the employers (one halfpenny per hour advance, stabilisation, consolidation of rates, and special consideration of the London position), and 41,516 against. The majority for acceptance is 27,451, and the strike has been averted.

French Visit to Holland.—At the invitation of the Association of Directors of Electrical Works in Holland, a committee of the French Union des Syndicats de l'Electricité paid a visit of inspection to Holland in the third week in May in order to study on the spot the conditions under which the supply of electricity is organised in that country. Besides seeing a number of supply stations, the committee paid visits to various electrical manufacturing works, and the results are expected to be a development of electrical relations between the two countries.

Private Arrangement.—WILLIAM ALFRED BURRELL, trading as the Burnley Electrical Maintenance Co., 12, Plumbe Street, Burnley.—The creditors interested herein were called together recently at Burnley, when a statement of affairs was submitted, which disclosed liabilities of £1,300, all due to unsecured creditors. The statement showed a deficiency of £1,020. Of the liabilities, £650 was due to trade creditors and £645 to cash creditors. The latter included the bank, who were creditors for £152, in respect of which they held a guarantee up to £150. The matter was discussed at some length, and it was resolved that the debtor should guarantee a composition of 4s. in the £ to all the trade creditors within seven days, failing which, the deed which had already been executed to Mr. T. Parkinson, C.A., of Burnley, should be confirmed.

Catalogues Wanted.—MESSRS. PHILIP HENRY & Co., wholesale distributors of gasfilled and metal-filament electric lamps, 15, Woodstock Road, Moseley, Birmingham, are desirous of receiving catalogues of electrical goods and accessories, &c.

Local Exhibition.—ENGINEERING EXHIBITION AT CARDIFF.—Under the auspices of the South Wales Institute of Engineers, an exhibition of electrical, mechanical, and workshop appliances, &c., will be held at the Drill Hall, Cardiff, from November 27th to December 6th, 1924. Applications for space must be made by August 30th. For full particulars see our advertisement pages to-day.

Russian Industrial Notes.—*Peat as Fuel.*—The "Red October" generating station, which is operated with peat as fuel, and ensures a part of the supply to Petrograd, is in need of funds so as to increase the output and work at full load. It is now proposed to grant a further loan to the station in order to enable it to get the production of peat increased from 64,000 tons per annum to 128,000 tons, and thus ensure the supply of the requisite further steam power.

Progress in the Donetz.—The management of the Chem-Ugol (Chemical-Coal) Trust proposes to proceed with the electrification of the Lisichanski coal district of the Trust in the near future by the addition of four 6,000-kW turbo-generators at the electrical station of the Donetz Soda Works. As a result of this development it will be possible to electrify the undertakings of the Trust in the district of Konstantinobsk and also supply energy to the town of Bachmut and the adjoining localities, while the cost of production is expected to be reduced by 30 per cent.

Control of Constructional Works.—A proposed decree is under the consideration of the State Planning Commission in regard to the order of the equipment and registration of electrical stations, the object being to ensure the technical direction of constructional works. It has been found in a number of cases that local stations have developed defects which are ascribed to insufficient care in the preparation of the original schemes. It is now hoped to remedy matters in this direction in the future by placing in the hands of one authority the consideration, supervision, and confirmation of electric station schemes.

The Moscow Tramways.—The question of continuing to ensure the supply of energy to the tramways in Moscow has arisen in connection with the growth of the traffic and the wearing out of the plant at the tramway power station. Two proposals have been made to overcome the difficulty: either to lay down new plant or obtain a supply of power from the district supply trust known as the Moges. The latter suggests that its network should afford a supply, but as there is a difference in the frequency used (20 periods as against 50 periods), it would be necessary for machines to be provided to adjust the periodicity if the suggested solution were adopted.

The Petrograd Trust.—The operations of this machinery trust are reported to be developing in intensity. Orders have been received for a central station plant for Ekaterinburg of the value of 440,000 roubles, a transmission line at 35,000 volts from the Shaturski station, at a cost of 1,000,000 roubles, and transformers for a sub-station in the Nischi Novgorod district. Work is proceeding on the completion of the plant for Tiflis, the Zemovchalski hydro-electric works with four generators and hydraulic turbines of 4,000 kW and transformers for 6,000 to 37,000 volts, together with underground and overhead cables. These orders will be completed at the beginning of next year.

Unemployment.—There was a further reduction in the number of unemployed during the week ended May 19th. The total was 1,021,000, a decrease of 5,138 for the week and of 264,600 since the beginning of the year.

American Competition in Argentina.—British electrical manufacturers may well be encouraged by some recent successes in the Argentine market, but they should not forget that their United States competitors will make a severe struggle to retain the footing which they gained during the war.

A comparatively new development of American competition appears to be the importation into Buenos Aires of parts of the heavier apparatus which are assembled there prior to delivery. This method is mentioned by the American Vice-Consul at Buenos Aires and seems to be something more than the customary practice of shipping the bedplate and certain parts separately for assembly on site. He adds, however, that the American electrical firms do little, or no, manufacturing locally. In his view competition from European electrical concerns is meeting with success only in the smaller and cheaper electrical lines, whilst his countrymen have been able to maintain the lead in all heavier equipment.

In urging his countrymen to continue their efforts he points out that Buenos Aires probably has as large a *per capita* consumption of electricity as any city in the world. "All homes except those of the very poorest classes are electrically lighted, stores and public buildings are all well illuminated, and the Government is widely known for its extensive use of electrical displays for decorations on the numerous holidays and festivals. Electricity is also extensively used for power, and to some extent for heat. The lack of heating facilities in the houses would point toward a good market for electrical heating appliances, especially among the foreign colony. The native population have become used to the cool, moist, winters and are not so prone to use artificial heat. Buenos Aires has not, however, made very great progress in the use of electric signs as a means of advertising. Numerous small electric signs dot the city, but electrical advertising as known in the United States has not yet received the approval of the Argentine business man.

Copper and Lead Prices.—Messrs. F. Smith & Co. report June 3rd:—Copper (electrolytic) bars, £67 10s., 10s. increase; do. do. sheets, no change; do. do. wire rods, £77 10s., 10s. increase; do. do. h.c. wire, ¼d. increase.

Messrs. James & Shakespeare report June 4th:—Copper bars (best selected), sheet and rod, no change; English pig lead, £32, £1 increase.

Lighting and Power Notes.

Abergele.—ELECTRICITY ORDER.—The Urban District Council has applied to the Electricity Commissioners for an Order authorising it to supply electricity in the urban district of Llanddulas, and the parishes of St. George and Abergele. The estimated cost of the scheme is £7,500.

Bexhill.—YEAR'S WORKING.—The report of the borough accountant on the electricity undertaking for the year ended March 31st last records a gross profit of £10,517, a decrease of £2,728 on that of the previous year. The working expenses increased by £1,011, while the income decreased by £1,717. After making provision for repayment of loans, income tax, &c., and adding a sum of £150 in respect of income tax recovered, there remained a net profit of £959, as compared with £5,032 in the previous year.

Belfast.—YEAR'S WORKING.—In his report for the year ended March 31st last, the city electrical engineer (Mr. Johnstone Wright) states that the net profit was £68,000, the revenue having increased by £24,471, and the total cost of production reduced by £10,508. In the previous year the net profit was £25,848. The amount of energy sold increased from 31,644,322 to 37,601,272 kWh, and the fuel consumption per kWh generated decreased from 3.43 to 2.62. The improved figure represents an annual saving of £20,000. The sales were improved by a bulk supply to Messrs. Harland & Wolff, who have shut down their own generating station; tramways and general lighting and power also showed increased consumption. The report points to the heavy capital charges which the undertaking has to bear, but recommends certain reductions in charges. During the year the East Bridge station has been shut down, and the Harbour station has been put into commission, the plant being transferred, at great risk of interruption of supply, from a temporary station. The new 12,500-kW turbo-alternator has been on load with beneficial effect upon the generating costs. The second section of the power house, consisting of four boilers and equipment, was completed early this year. A payment of £150,000 on account of the British Government's commitments in connection with the capital cost of the original extension scheme has been sanctioned. The greater part of the plant included in the extension scheme sanctioned in 1922, comprising a second 12,500-kW turbo-alternator and auxiliaries, has been delivered, but erection is held up by the slow progress in building. The coal-handling and circulating water systems have been improved during the year, and practically the whole of the transmission and distribution systems have been changed. The sum of £138,910 is being spent upon new cables and sub-station plant.

Bexley.—LOAN SANCTIONED.—The Urban District Council has received the sanction of the Electricity Commissioners to a loan of £20,000 for the following purposes:—Main transmission line, £9,000; mains, £8,500; converting plant, £2,500.

Budleigh Salterton (Devon).—ELECTRICITY SCHEME.—A meeting of the Urban District Council was recently held to consider the electric lighting question. A motion was proposed that the Council should acquire the Special Order from Mr. T. H. Thompson and proceed as early as possible with the development of the scheme. An amendment was carried to the effect that Mr. Thompson be informed that the Council could not accept his offer, but would give every facility to any company to carry out the Order.

Bridgend.—EXTENSION OF SUPPLY.—At a meeting of the Urban District Council on May 13th, it was stated the Council proposed to extend its electricity undertaking. Application for an electricity supply had been received from the Renybont Council and the Parish Councils of Pencoed, St. Bride's Minor, Yuegsawdre and St. Bride's Major. The Council had already decided to enter into negotiations with the Pencoed Council regarding a supply in the Kenfig Hill area.

Burnley.—EXTENSIONS.—The General Purposes Committee has authorised the electrical engineer to lay 2,827 yards of mains at a cost of £2,770, and to install a rotary and a motor converter at an estimated cost of £5,000.

Canada.—OTTAWA RIVER POWER DEVELOPMENT.—The first step in a plan to develop 700,000 h.p. on the Ottawa river, to be distributed throughout the province, was taken by the

Hydro-Electric Power Commission when application was made to the Ontario Government for certain water leases between Ottawa and the town of Pembroke. Preliminary investigations by engineers will commence immediately. Plans are also to be drafted, and financial provision for the work will be made in the estimates to come before the next sitting of the legislature. Sufficient funds are now available for the survey portion of the work.—*Reuter's Trade Service* (Ottawa).

ONTARIO.—The annual statement of the Ontario Hydro-Electric Commission gives the revenue as $15,743,000, leaving a surplus of $845,000. The power distribution during the year totalled 685,000 h.p., being an increase of 123,000. The total capital investment is now $241,853,000.—*Reuter* (Toronto).

Caterham.—ELECTRICITY IN BULK.—The County of London Electric Supply Co. has applied to the Electricity Commissioners for sanction to provide a bulk supply of electricity for the district.

Continental.—RUSSIA.—The Council of People's Commissaries has decided to establish a so-called "Electrobank" for the financing of electrical development. It is proposed to erect power stations at Schatur, Volkhoff, and Nijni-Novgorod, whereby Leningrad and Moscow would secure an additional 80,000 kW. The electrification scheme is intended to contribute towards promoting the economic life of the country.—*Reuter* (Moscow).

Dolgelly.—ELECTRICITY IN BULK.—The Urban District Council, having abandoned its intention of providing its own power station, has re-opened negotiations with the Cambrian Electricity Supply Corporation, Ltd., for a supply of electricity for the town.

Dover.—YEAR'S WORKING.—The report of the borough electrical engineer (Mr. R. C. Harpur), shows that the revenue from the electricity undertaking for the year ended March 31st last amounted to £49,914. Working expenses totalled £19,542, leaving a gross profit of £30,372. After deducting capital charges there was a surplus of £8,641, against which, however, was charged an adverse balance from the previous year of £9,670, leaving a net deficit to be carried forward of £1,029. The electrical energy sold during the year amounted to 1,786,017 kWh.

Exeter.—YEAR'S WORKING.—In his report on the Corporation electricity undertaking for the year ended March 31st last, the electrical engineer, Mr. H. D. Munro, states that the total amount of electrical energy sold was 3,091,745 kWh, an increase of 346,850 kWh. During the year 380 additional consumers were connected, bringing the total to 3,391. This increase is 25 per cent. greater than in the previous year and forms a record. Nearly seven miles of mains, including 1¼ miles of high-pressure feeders, were laid, and the total length of high and low-pressure mains now laid amounts to 75 miles. After considering a report from the city treasurer, the Electricity Committee recommended that of the net surplus for the year of £5,726, £1,750 be contributed to the relief of the general district rate, the remaining £3,976 be carried forward, that as from June 1st a reduction of 5 per cent. discount be allowed to consumers for prompt payment of accounts and that the electrical engineer report upon systems of alternative domestic tariffs to private consumers. The Committee has asked the Lighting and Cleansing Committee to confer with it with a view to the extension of street lighting by electricity.

PLANT EXTENSIONS.—The Electricity Commissioners have consented to the extension of the power station, the work upon which has to be commenced by June 16th. A 1,500-kW steam turbo-alternator is being purchased from the Brush Company for £10,090. The Unemployment Grants Committee has undertaken to provide half the loan interest on the expenditure, not exceeding the following amounts:—£68,000 for a period of 15 years and £12,000 for a period of ten years.

Fleetwood.—LOAN SANCTIONED.—The Urban District Council has received sanction from the Electricity Commissioners to borrow £2,015 for a new feeder cable from the electricity works to London Street.

Glasgow.—ELECTRICITY IN BULK.—The Clyde Valley Electrical Power Co., Ltd., proposes to take a bulk supply of electricity from the Corporation for the purpose of giving a supply to houses at Riddrie Knowes and Barlinnie Prison, and the Electricity Committee has recommended that a supply be given, and that terms of agreement be prepared.

Honley.—SUPPLY AREA EXTENSION.—The Urban District Council is applying to the Electricity Commissioners for a Special Order authorising it to extend its area of electricity supply so as to include the urban district of Thurstonland.

Irish Free State.—ELECTRICITY SUPPLY BILLS.—The two Houses of the Free State Parliament have decided to appoint a Joint Committee to consider the Dublin Electricity Supply Bill promoted by the Corporation. The Speaker of the Dail states that the report of the Joint Committee need not be expected until October. It has also been decided to appoint a Joint Committee in connection with the East Leinster Electricity Supply Bill.

KINGSTOWN.—Work on the long-delayed electric lighting scheme was recently commenced. It is nearly ten years since it was promoted by the Urban District Council, and a Provisional Order obtained, but the intervention of the war was responsible for the holding up of the project. All the financial arrangements for carrying out the undertaking have now been completed, and contracts amounting to £30,000 entered into with various firms. The engines and alternators will be supplied by Messrs. Mirrlees, Bickerton & Day. Messrs. Watshams have been entrusted with the contract for supplying and laying of cables, Messrs. Drake & Gorham, Dublin, for the switchgear and transformers, and the Irish Electrical Constructional Co. for the overhead distribution system. It is hoped that a supply will be available by September 1st next. Messrs. Tierney & Co., Dublin, are the consulting engineers for the scheme.

London.—BATTERSEA.—The borough electrical engineer has submitted a report to the Electricity Committee on the proposal to increase the electricity supply in the Clapham Junction and southern districts, which provides for a h.p., a.c. main to be laid from the power station to Chatham Road. In order to continue the present d.c. supply until such time as the change-over to the a.c. system takes place, he suggests that the 500 and 450 kVA rotary converters be moved from the power station and installed in the old engine room at Chatham House or on a suitable site in the locality. The estimated cost of the scheme is £15,000, and the Electricity Committee has recommended to the Borough Council that it be adopted.

Luton.—SUPPLY AREA EXTENSION.—The Town Council has assented to the proposal of the Electricity Commissioners that the proposed extension of the area of supply be reduced by the exclusion of Newport Pagnell, Apthill, and Hitchin Rural Districts, and Bletchley, Stevenage, Letchworth, Hitchin, and Baldock Urban Districts, subject to the Commissioners giving in a Special Order such powers as may be necessary to enable the Corporation to lay a main, when required, between Luton and Hitchin, so that a bulk supply may be given when needed.

The Hitchin Urban District Council has withdrawn its opposition to the Council's scheme for providing a bulk supply for the district.

Maentwrog.—HYDRO-ELECTRIC SCHEME.—Work on the dam at Trawsfynydd, Merionethshire, in connection with the new hydro-electric power station which the North Wales Power Co. is to erect at Maentwrog, has commenced. The electricity from this source will supplement the output of the company's station at the foot of Snowdon. The work will take several years to complete and will involve an expenditure of about £1,500,000.

Preesall.—ELECTRICITY IN BULK.—The Urban District Council has approved a draft agreement for a supply of electricity in bulk from the North Wales Power Co.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

HOYLAKE AND WEST KIRBY:—Private lighting: First 500 kWh, 6½d. per kWh; next 500 kWh, 4½d.; next 500 kWh, 4d.; all energy in excess of this amount 3½d. per kWh. Public lighting: 5d. per kWh. Power, heating and cooking: 3d. per kWh.

Rhyl.—ELECTRICITY IN BULK.—The Urban District Council has entered into an agreement with the North Wales Power Co. for a bulk supply of electricity. The supply will be transmitted to Rhyl at a pressure of 6,600 V, and will be available by August 1st.

Torrington.—ELECTRICITY SUPPLY.—The Rural District Council has decided to give its formal consent to the Bideford and District Electricity Order. All the public authorities concerned in the scheme have now given their consent.

Tylorstown (Glam.).—FIRE.—According to the *Financial Times*, a fire broke out at the power station of Messrs. D. Davis & Sons on May 29th, causing damage estimated at £250,000. The station supplies electrical energy to a number of the company's pits, and in consequence about 10,000 men will be unemployed for several days. A supplementary supply of electricity has been arranged with the South Wales Electrical Power Distribution Co. It is thought that the cause of the outbreak was a flash of lightning.

United States.—MUSCLE SHOALS SCHEME.—According to the *Daily Mail* the Agricultural Committee of the Senate has rejected Mr. Henry Ford's offer for the concession in connection with the Muscle Shoals nitrate and power scheme in Alabama. Mr. Ford is reported to have offered £40,000,000 for the concession.

Worcester.—INAUGURATION OF NEW PLANT.—On May 29th, the Mayor formally opened the extensions to the electricity works, and the new 3,000-kW set was started by the Mayoress.

POWER STATION FLOODED.—Owing to the heavy rainfall during last week-end, the power station was flooded, and had to be shut down on Monday last. It was expected that the electricity supply would not be resumed for several days.

Tramway and Railway Notes.

Blackburn.—YEAR'S WORKING.—The accounts of the Corporation tramway undertaking (general manager, Mr. J. H. Cowell) for the year ended March 31st last show a total revenue of £115,130, as compared with £129,488 in the previous year. Working expenses amounted to £87,712 (£129,488), leaving a gross profit of £27,418 (£33,161). After deducting capital charges, &c., there was a net profit of £10,699, as against a profit of £21,358 in the previous year. The number of car-miles run was 1,119,050, a decrease of 52,004, and the number of passengers carried decreased from 16,389,348 to 15,904,168.

Continental.—CZECHOSLOVAKIA.—The Reichenberg-Gablonz-Tannwald Railway Co., a private company operating about 40 kilometres of railway in the textile manufacturing region of Northern Bohemia, is contemplating the electrification of its entire line. The cost of carrying through this project is estimated at 27,000,000 Czech crowns. The necessary funds are to be raised by means of a bond issue. The company wishes the Government to guarantee the proposed loan. The railway crosses mountainous country, and includes a rack-rail section of about 6¼ kilometres. It has been losing money rather consistently during recent years, and it is understood that the prime reason for electrification is to put the road on a paying basis.—*Commerce Reports.*

FRANCE.—An inquiry has recently been made as to the number and situation of the stations on the two lines of underground railway to be constructed under the Grands Boulevards of Paris. These two lines will be placed one above the other. The line from Porte Saint Cloud to the Chaussée d'Antin will be extended to the Place de la République, and will be situated at a depth of 16 metres. Between this line and the surface of the boulevard the other line will be constructed.

Coventry.—LOAN SANCTIONED.—The Corporation has received the sanction of the Ministry of Transport to the borrowing of £38,500 for track renewals.

Glasgow.—NEW CARS.—The tramway manager has been authorised to proceed with the construction of 30 new tramcars.

ELECTRIFICATION OF SUBWAY RAILWAY.—In connection with the proposal to electrify the subway, the Tramways Committee has recommended that Mr. W. C. Easton, consulting engineer, should visit Paris to inspect the electrification system there.

Huddersfield.—YEAR'S WORKING.—For the past year the income from the Corporation tramways was £277,671, plus £17,874 from the motor-bus service. Working expenses amounted to £225,417, leaving a gross surplus of £70,128. After deducting capital charges, &c., there remained a net surplus of £15,104, which has been placed to reserve or renewals account.

London.—UNDERGROUND EXTENSIONS.—Contracts for the construction of the Morden Tube extension and the extension of the Hampstead Tube beyond Charing Cross, linking up with the City and South London line at Kennington, have been placed, and it is expected that fast electric trains will be running between Clapham Common and Morden by December, 1925. The Kennington loop is scheduled to be completed by October, 1925. The new line will be approximately two miles long, and an intermediate station at Waterloo will enable Hampstead line passengers to journey direct to Waterloo instead of changing at Charing Cross as now. Similarly, passengers arriving at Waterloo will be able to proceed to any station on either the Bakerloo or Hampstead lines. The extension of the Hampstead line beyond Hendon to Colindale, Burnt Oak, and Edgware is now rapidly approaching completion, and it is hoped to open this line in July. The southern section of the City and South London Railway between Moorgate and Clapham Common will also reopen for traffic in October of this year. Escalators are being constructed at the Oval and Clapham Road, and new stations have been erected at Clapham Common and Stockwell, both of which will also be equipped with escalators.

Northampton.—YEAR'S WORKING.—The accounts of the Corporation tramway undertaking (general manager Mr. J. F. Cameron) for the year ended March 31st last show a total revenue of £76,035, as compared with £75,035 in the previous year. Working expenses amounted to £50,549 (£54,431), leaving a gross profit of £25,693, to which was added a gross profit of £363 from the motor omnibus service, making a total gross surplus of £26,056 (£20,822). After deducting capital charges there was a net surplus of £15,053, as against £11,039, which was distributed as follows:—Reserve fund, £3,250; on account capital outlay, £2,625; rate relief, £7,060; to be reserved, £2,118. The number of car miles run was 822,141, as compared with 818,185 in the previous year, and the number of passengers carried increased from 11,266,592 to 12,121,947.

Oswaldtwistle.—NEW TRAMWAY TRACK.—The Blackburn Corporation proposes to lay a double tramway track at the Toll Bar House, Blackburn Road.

Rochdale.—NEW CARS.—The Tramways Committee has decided to order six new double-deck cars to replace six which are obsolete.

Staffordshire.—RAILLESS CARS.—The County Main Roads and Bridges Committee has had under consideration the proposals of the Wolverhampton Corporation to run railless-cars along certain main roads in the county area, and has decided in view of the importance of establishing such a precedent and the heavy cost of road construction and maintenance which the scheme would involve, that a meeting of representatives of the various authorities affected be convened to consider how such expenditure is to be met.

Telegraph and Telephone Notes.

Atlantic Cables.—NEW DIRECT SERVICE.—A direct cable service between London and Philadelphia was opened on May 28th, says *The Times.*

REPAIR OF FRENCH CABLE.—The French cable steamer *Edouard Jeramec* arrived at St. Johns last week for supplies from the area east of the Grand Banks, where the French Transatlantic cable, which had broken in deep water in that region, was being repaired. The work, it was stated, was proving very difficult.—*Daily Mail.*

Hull Telephone System.—YEAR'S WORKING.—The Hull Corporation Telephones Committee reports that the net profit on the municipal telephones for last year amounted to £21,000. The royalty tax was £11,322, making the total sum paid to the Government since the beginning of the service £96,552.—*The Times.*

Imperial Radio Communication.—ANOTHER COMMITTEE.—The daily Press announces that the Government is about to appoint a new committee, with Sir Robert Donald as chairman, to report on means for carrying into effect the report of the Donald Committee on the control of Imperial radio communication.

Italy.—PRIVATE EXPLOITATION OF TELEPHONES.—The commission appointed by the Minister of Posts, Telegraphs, and Telephones to draw up the *dossier* in connection with the transference of the Italian telephones to private industry has finished its labours. It is believed that the *dossier* will be promptly approved by the Cabinet and distributed by July to firms, or groups, wishing to take part in the adjudication.—*Reuter's Trade Service.*

Radio Telephony.—MESSAGE TO AUSTRALIA.—It is understood that on Sunday, June 1st, Senator G. Marconi spoke by means of radio-telephony to Australia. The message was transmitted from the Poldhu station in Cornwall, and a telegram has been received from Australia acknowledging its receipt.—*Daily Mail.*

Russia.—MANUFACTURE OF AUTOMATIC TELEPHONES.—The Leningrad Weak Current Trust has manufactured the first telephone apparatus in Russia connecting subscribers automatically, "without the use of a central exchange."—*Reuter's Trade Service* (Moscow).

Spain.—AUTOMATIC TELEPHONY.—The municipality of the Spanish town of San Sebastian has entered into a contract with the Almaenna Telefonaktiebolaget L.M. Ericsson for the introduction of an automatic telephone system in that town. It is understood that the provincial authorities in the same province are concluding a similar contract. This is considered to be the first step towards the conversion of the Spanish telephone service into an automatic system. The L.M. Ericsson Co. obtained the order in competition with several large foreign firms.—*Reuter's Trade Service* (Stockholm).

TELEPHONE SERVICE.—The Spanish Government has decided to appoint a commission to inquire into the best method of providing Spain with an efficient telephone service. An American company, as announced last week, has been acquiring a large number of concessions for the supply of material as well as for the control of services.—*Reuter* (Madrid).

The Telephone Service.—LONDON-BRISTOL CABLE.—The Postmaster-General announces that the London-Bristol telephone cable was opened for service on June 2nd. The cable is 122 miles in length, contains 616 wires, and could provide 462 channels of communication. It is divided into three sections by repeater stations, and the total weight of copper per mile is 5¼ tons. The cable will form the main channel for communication between London and the West of England, and it makes direct communication available for the first time between London and Plymouth.

Radio Notes.

Australia.—POLICE RADIO CARS.—A Melbourne message states that the recent serious increase in burglaries, combined with the relatively small recoveries of property, is making insurance companies reluctant to insure many trades. One police patrol is using a fast automobile equipped with wireless, and has done good work at night, but it is inadequate. It

is now proposed that the Police Department should treble this service. At least 200 firms are contributing to its upkeep as a form of insurance, and the Police Department favours the scheme.—*Daily Mail.*

REGULATIONS CONFERENCE.—The Conference concluded its deliberations on April 15th, and a report of the proceedings and the proposed amendments to the present radio regulations has been drawn up for submission to Mr. Gibson, the Postmaster-General, who recently expressed himself in favour of one big company to incorporate the seven present companies which have been formed to broadcast in Australia, under sufficient safeguards against a harmful monopoly. There will be no compensation paid in the event of a decision by the trade to abandon sealed sets in favour of "open" sets.

Broadcast Jamming.—ORIGIN TRACED.—Investigators who attempted to locate the origin of the jamming and interference which occurred in and around London during the broadcast programmes on May 27th reported that they had failed. 2LO closed down for five minutes at 8.45 p.m. to give an opportunity of testing the interference with direction-finding apparatus. There seemed to be no doubt that by a pure accident a French station happened to get on to the 2LO wavelength.

Broadcasting Stations.—NEW RELAY CENTRES.—The British Broadcasting Co. will open a new relay station at Hull at the beginning of August. A main station at Belfast is being put in commission. The company, in consultation with the Post Office authorities, has recommended that the next towns in which relay stations should be established shall be Nottingham, Stoke-on-Trent, Dundee, and Swansea. Uncertainty still exists with regard to the new site for 2LO, but the matter is still under consideration by the Postmaster-General's advisory board. The opening of the Liverpool relay station has been postponed until Wednesday, June 11th, and Chelmsford cannot begin transmitting before the last week in June. Tests are taking place with a view to broadcasting some of the characteristic sounds of the animals and birds at the Zoo. This follows the recent successful broadcasting of the nightingale's song from a Surrey garden.—*Daily Mail.*

China.—BROADCASTING.—Regular radio broadcasting has been introduced by the *Shun Pao*, the first Chinese newspaper to take up the matter.—*Reuter* (Shanghai).

Hungary.—BROADCASTING.—Negotiations are being carried on between the Hungarian Government and the British Marconi interests, with the intermediary of the British-Hungarian Bank, with the view of obtaining a broadcasting monopoly for Hungary. The British Marconi group has an important participation in the British-Hungarian Bank, and it is believed that the Hungarian Government wants to obtain a sterling loan in exchange for the concession.—*Financial News.*

Radio at Sea.—ADMIRALTY WAVE LENGTHS.—Portsmouth port orders state that the Admiralty is considering the matter of reducing below 300 metres the destroyer wavelength, which at 310 metres is found to interfere with the programmes of the British Broadcasting Co. In the meantime signalling on a destroyer wavelength is directed to be reduced as much as possible between 7 and 10.30 p.m.—*The Times.*

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the ELECTRICAL REVIEW *in which the "Official Notice" appeared in our advertisement pages.)*

Open.

Australia.—MELBOURNE.—June 30th. City Council. 100 single light units, complete with Goliath or Mogul sockets, for ornamental street lighting; 185 ditto, with Standard Edison screw sockets; ten 2-light units, with standard Edison screw sockets.*

August 4th. State Electricity Commission. 66,000-V insulators. (May 23rd.)

September 15th. Bushing insulators for 6,000-V, trifurcating boxes. (See this issue.)

NEWCASTLE (NEW SOUTH WALES).—June 12th. City Council. H.p. submarine cables and accessories.*

SYDNEY.—July 14th. Municipal Council. Voltage regulators.*

July 28th. A.c. and d.c. consumers' meters.*

Belgium.—July 5th. Municipal authorities of Diest (Province of Brabant). Electrically-operated pumps. Particulars for 15 fr.

June 18th. Ministry of Railways, Marine, Posts, and Telegraphs. 20,000 kilos of bare phosphor bronze cable.*

July 27th. Municipal authorities of Antwerp. Fifteen 3-ton electrically-operated cranes on the quays of the No. 3 dock. Particulars from Hotel de Ville for 4 fr.

Bridgend.—June 11th. Urban District Council. Two 1,000-kW turbo-alternators and condensing plant; one 500-kW alternator and gearing. (May 30th.)

Bristol.—June 9th. Docks Committee. Three 2-ton movable electric jib cranes. Mr. T. A. Peace, Chief Engineer's Office, Avonmouth Docks.

Edinburgh.—June 9th. Electricity Supply Committee. 33,000-V overhead main transmission line. (May 23rd.)

Irish Free State.—DUBLIN.—June 30th. Postmaster-General's Department. 400 wall-pattern telephones, with magneto, bell, and generator; 100 table pedestal pattern; 2 6.0 hand micro pattern, with press key; 1,000 table box pattern, with magneto, bell, and generator. (See this issue.)

Leeds.—June 16th. Electric lighting installation at schools. Specifications, &c., from Education Offices (Architect's Section), Calverley Street, Leeds.

London.—INDIA STORE DEPARTMENT.—June 20th. Lead-sheathed, armoured, dry core cable. (May 30.)

METROPOLITAN ASYLUMS BOARD.—June 18th. Automatic telephone system at Darenth Training Colony, Dartford, &c. (See this issue).

June 18th. 144-tube economiser, engineering work for new central boiler house, drying machine, revision of laundry engineering arrangements, installing electric lighting and power wiring in boiler house and laundry, covering boilers, steam, feed and suction mains, &c., with non-conducting composition at the South-Western Fever Hospital, Stockwell, S.W. (See this issue.)

HAMMERSMITH.—June 16th. Electricity Department. H. and l.p. paper-insulated cables, 100-kW and 250-kW air cooled and 1,000-kW oil cooled transformers. (See this issue.)

METROPOLITAN WATER BOARD. July 2nd. Three electrically-driven reciprocating air compressors and two electrically-driven centrifugal pumps, piping, &c., at Walton pumping station. (See this issue.)

New Zealand.—TAIHAPE.—August 1st. Borough Council. Turbo-generator, pressure governor, and automatic weir for the Taihape hydro-electric station.*

WELLINGTON.—August 14th. City Council. One electrically-driven multi-stage turbine pump complete.*

Plymouth.—June 12th. Electricity Department. C.i. pipes. (May 23rd.)

Renfrewshire.—PAISLEY.—June 16th. Education Authority. Works, including electric lighting installation in connection with special classes school annexe, Paisley. Schedules from Executive Officer, Paisley.

Salford.—June 16th. Electricity Committee. Ventilating plant. Particulars from borough electrical engineer, Frederick Road, Pendleton.

Scarborough.—June 18th. Board of Guardians. Installation of storage battery, 300-Ah capacity, complete, and booster set. Mr. J. W. Read, clerk to Board of Guardians, 14, Dean Row.

Southall.—June 10th. Southall-Norwood Urban District Council. Maintenance of the fire alarm system. (May 30th.)

South Africa.—JOHANNESBURG.—June 23rd. Municipal Council. Electric lamps and watertight fittings for street lighting.*

Spain.—CARTAGENA.—June 27th. Junta de Obras del Puerto de Cartagena. One rolling electric crane of 20 tons. Particulars from Señor Presidente de la Junta de Obras del Puerto de Cartagena, Cartagena, Spain.—*Reuter's Trade Service* (Madrid).

Uruguay. — MONTEVIDEO. — July 8th. State Electricity Works. Six 6,000/200-V, 3-phase transformers, l.p. switchboard and accessories.*

July 9th. Copper wire and cable.*

July 24th. 82,000 metres of v.i.r. wire and cable.*

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Australia.—SYDNEY.—Messrs. Johnson & Phillips, Ltd., have just received an order from the Municipal Council for four 6,200-kVA, 3-phase forced oil-cooled transformers against world competition.

MELBOURNE.—The Postmaster-General's Department has placed orders for telephone switchboard cable, &c., among the following firms:—Western Electric Co., Ltd.; British Insulated & Helsby Cables, Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Siemens Bros. & Co., Ltd.; and the Peel-Conner Telephone Works. The total value of the orders is approximately £62,000.—*Reuter's Trade Service* (Melbourne).

Bradford.—Tramways Committee.

50 chrome nickel steel axles (£255).—Vickers, Ltd.
200 steel poles (£1,715).—British Mannesmann Tube Co., Ltd.
5 tons steel tiebars (£16 10s. per ton) and special trackwork (£1,349).—Hadfields, Ltd.
Welded rings, &c. (£1,154).—William Jones.
Copper bonds.—British Insulated & Helsby Cables, Ltd.
133 tons mild steel bars (£11 15s. per ton).—A. C. Barrett & Co.
1,500 welding portions (30s. each).—Thermit, Ltd.

Colombia.—Cartagena Waterworks, Ltd.

Underground cables and boxes for the City of Cartagena electrical distribution system.—Callender's Cable & Construction Co., Ltd.

Halifax.—Electricity and Tramways Committee.

1,500-kW rotary-converter (£5,267).—British Thomson-Houston Co., Ltd.

(Continued on page 930).

The Tirso Hydro-Electric Scheme.

An Important Installation in Sardinia.

PERHAPS the most interesting plan of hydro-electric development among all those in course of execution in Italy is that relating to the island of Sardinia.

Sardinia is at present the poorest province of Italy. It is stricken with malaria in the plains and upland plateaus. The population, which numbers approximately 860,000 souls, amounts to only 37 per square kilometre. The rainfall is extremely small, ranging from only 15 in. annually in the plains to 42 in. on the mountain summits; moreover, it is very badly distributed. In the catchment area of the river Tirso, for example, 3 per cent. of the total annual rainfall occurs during 229 days of the year, the remaining 97 per cent. occurring on 136 days; and, again, the greater part of the 97 per cent. occurs on less than 30 days. Since most of the island is formed of ancient impermeable rock, only very partially wooded, the result is a quite extraordinary variation in the *régime* of the rivers. Thus, the mean run-off into the Tirso is 24 cubic metres per second, but during certain seasons of the year it dwindles to 2, and in times of flood increases to no less than 1,200.

The precious water is, consequently, very largely wasted, being carried off into the sea unused for the most part; at the same time the greatest damage by erosion and flood are caused by it at flood times. When agriculture in the plains is chiefly in need of irrigation, little or no water is available—that is, during the hot dry summers; the flood water tends to dry up, forming stagnant marshes which breeds malaria insects. On the upland plateaus the same conditions occur to the pools formed in the hollows during the rainy season, and then the lack of water strictly limits the number of sheep and cattle that can be reared, which form the chief support of the people in these districts.

Fig. 1.—Tirso Dam and Tail Race.

Fig. 2.—Down Stream View of Dam.

Nevertheless, Sardinia is a land of very considerable natural wealth. In the plains, which are of an important extent, the land is extremely fertile. The upland plateaus could support double the present number of sheep and cattle, and could be partly put to agricultural purposes were water available. Lastly, there is important mineral wealth in the shape of rich deposits of lead, zinc, copper, and silver, some of which are worked, but many of the richest deposits are away in the mountains and only the provision of cheap power can bring to them commercial exploitation. Coal is expensive, so that even those deposits that are worked are not treated on the spot, but are exported.

Sardinian economics, therefore, present a very special problem; and the problem has been faced in all its complexity by the great Italian water engineer, Commendatore Angelo Omodeo, who is responsible for a large number of the most important hydro-electric schemes executed in Italy.

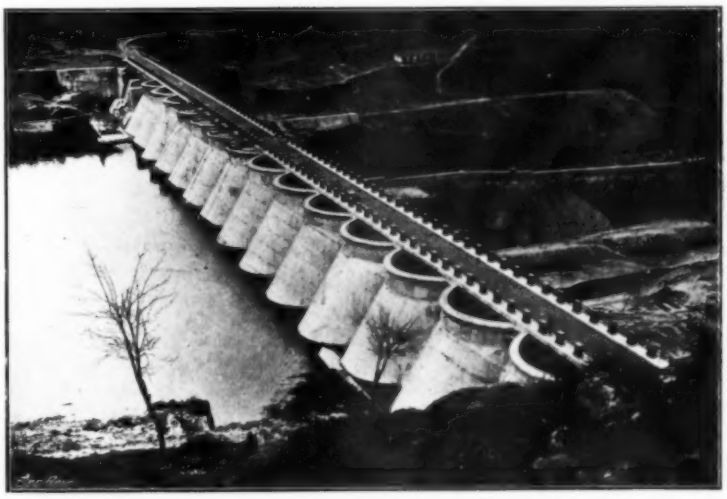


Fig. 3.—Up Stream View of Multiple-Arch Dam.

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Signor Omodeo himself is a Sardinian, and he has worked out a general plan of development for the island which has received the approval of the Government. The topography of the island lends itself, unlike Sicily, to the creation of large artificial lakes by means of dams closing the deep and narrow gorges of the rivers where they leave the upland plateaus for the plains. Signor Omodeo's plan envisages the creation of between 20 and 30 such lakes, which will serve a number of useful purposes, namely, the regularisation of the rivers' regime below the dams, the provision of abundant water for the flocks and herds above the dams, the provision of constant power for the mines, for general industry, for special electrolytic industries, for agriculture and for pumping, the prevention of erosion and flooding and, by restoring the water after utilising it for power purposes into the old river bed at a height above sea level of from 40 to 80 ft., and by constructing at this point minor reservoirs and conduits, the provision of water at all seasons of the year for irrigation on the plains. The scourge of malaria will thus at the same time be most effectively tackled.

Fig. 4.—The Power House.

The Societa Imprese Elettriche del Tirso was formed shortly after the war for the purpose of initiating this very comprehensive scheme. The Banca Commerciale Italiana is the chief shareholder, and Messrs. Vickers have also an important holding. The Italian Government has, moreover, allocated a considerable subsidy, as the work is considered of national importance. Commendatore Dolcetta is the managing director.

The first stage of the scheme, which as a whole must necessarily take nearly a generation to realise, is now complete so far as the impounding of the waters of the river Tirso (running into the Western Mediterranean) and the installation of the power plant are concerned. The complementary land reclamation and irrigation works are in hand, while the second stage of the scheme, which deals with the river Coghinas (running into the Straits of Bonifacio) has been commenced, and is already under way. It is the Tirso scheme with which we are concerned at the moment.

The dam has been constructed at a point about eight miles south-east of the railway station at Abbasanta, and at a distance of 19 kilometres as the crow flies from the western coast where the Port of Oristano lies. It is 233 ft. in height from the base of its foundations to its crest, or 203 ft. in height from the bed of the river to the maximum level of the water in the reservoir; the latter level is 363 ft. above the level of the sea.

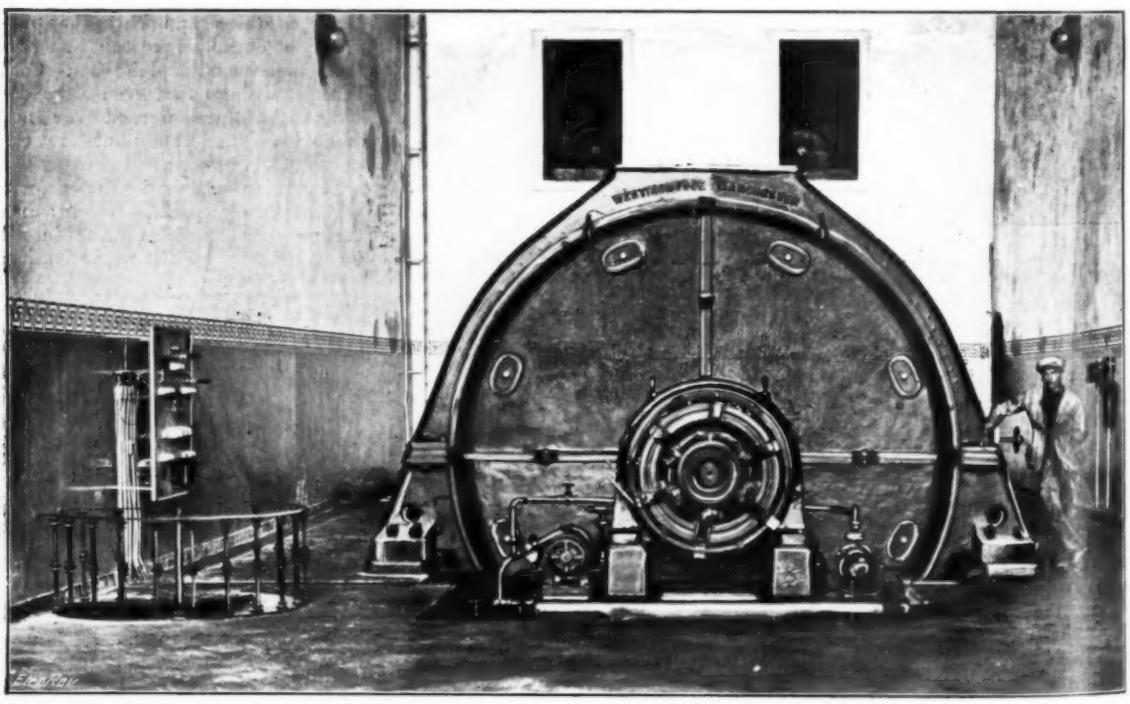

Fig. 5.—A 6,000-B.H.P. Metropolitan-Vickers Generator.

The form of construction adopted (from the designs submitted in the first instance by engineer Luigi Kambo) is known in Italy as the "multiple arch system," first used on a large scale in America. The Tirso dam is the highest in the world of its kind. It consists of 17 bays of reinforced concrete which divert the main thrust

of the water on to great piers of masonry standing between them. Each bay is 30 ft. wide, so that the total length of the dam from shore to shore is 510 ft. The piers have an inclination of 1 in 0.651 on the reservoir side, and 1 in 0.394 on the river side, and are further bound together by a series of arches, the highest supporting the road which runs along the top of the dam, the lowest supporting the floor of the power house and the platform outside at the base. The bays are faced below the water level with asphalt; at their base they are 2½ metres thick, and their foundations below the bedrock are 2 metres deep.

The storage reservoir, which is thus created, has a capacity of impounding the water of the Tirso catchment area above the dam (2,100 sq. kilometres) to the amount of 416 million cubic metres, sufficient to regulate completely the discharge below the dam. Its greatest length reaches 26 kilometres (16¼ miles), its greatest width 3 kilometres (nearly 2 miles), and its maximum depth 220 ft. A whole village was submerged by the operation, and has been rebuilt on the shore of the lake higher up, the old historical church having been re-erected stone by stone.

The power house is situated at the base of the dam between the piers, and is equipped with two double turbines of 6,000 b.h.p. each, two double turbines of 9,000 b.h.p. each, and a small auxiliary turbine of 60 b.h.p., which provides power for internal uses.

Each of the four larger double turbines is fed by two pipes which penetrate four of the central bays, at these points specially reinforced. The entrance to the pipes is protected by an inclined grill, and each can be closed in three different ways, namely, by a simple gate at the entrance, by a horizontal trap door, and by the turbine distributors. Since each pipe feeds a single turbine, half the water may be thus cut off without reducing the speed of the machines.

The shafts of the turbines, which are horizontal, are 37 ft. above the river bed at the base of the dam, and as the normal depth of the water at this point is 16 ft., the suction is as much as 21 ft. The discharge is effected through steel pipes 0.95 metre in diameter, and 17 ft. in length, embedded in the masonry below the platform: the latter, which is of strongly reinforced concrete, together with the masonry below it, takes most of the vibration, which is thus reduced to a minimum as far as the piers are concerned.

Fig. 6.—Part of the Switchboards.

This form of dam is particularly accessible for inspection. A long drain running the whole length of the masonry at the back carries away such infiltration as takes place. Besides the discharge through the turbines, which may be made to reach a maximum of 400 cubic metres per second, further ample means of discharge are provided. Two of the bays near the left bank are equipped with automatic sluices which rise as the water rises until a point is reached when they automatically begin to descend again. They can also be manœuvred mechanically, and may be set to work automatically as required. They are capable of discharging up to 800 cubic metres per second. In addition, there is a low-level discharge, operated by four lock gates, close against the left bank, leading into a short flume which empties itself into the river about 100 yards below the dam. This is also capable of discharging water at the rate of 800 cubic metres per second, so that the total emergency discharge could reach the figure of 2,000 cubic metres per second, equal to nearly one cubic metre for every square kilometre of the catchment area.

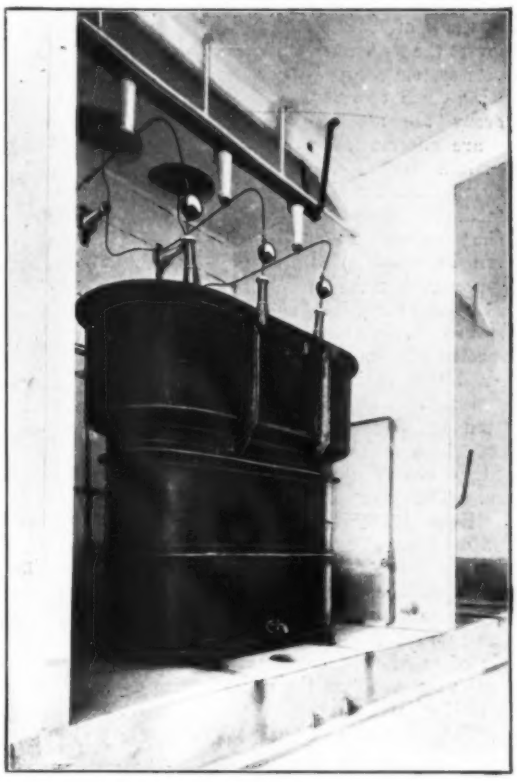

Fig. 7.—A 75,000-V Transformer.

Two of the four turbines (those of 6,000 b.h.p.) are by Messrs. Vickers, two by the Societa Generale dell' Elettricita, the Italian company of the American General Electric Co. The total b.h.p. installed is accordingly 30,000. The alternators built by Messrs. Rivarolo Ligure are 3-phase, 50-cycle machines, and run at 428 r.p.m. They are excited by means of dynamos carried on extensions of the shafts. They generate at 5,000 volts, and are coupled rigidly to the transformers (also by Messrs. Rivarolo Ligure), situated on the floors above, which transform the voltage up to 75,000 volts. By means of special bus-bars any one alternator may be coupled to any one transformer; and for the high pressure there are two independent switch systems.

The whole of the switchgear is housed on the floor above the transformers. The measuring instruments are

by the C.G.S.; the switchboard is by Messrs. Magrini, Ltd., and the rest of the apparatus by Messrs. Magrini and the A.E.G.-Siemens Schuckert; the insulators are likewise by Messrs. Magrini, together with the other safety devices. Excess pressure on the lines is prevented by horn and liquid jet arresters; the current limiters on the alternators follow the Brown, Boveri system for preventing short circuits, whereby the alternators are automatically unexcited before the circuit breaker is opened.

The various floors (seven in number) of the power house, in which rooms for offices are also found, are connected with one another by a staircase and a lift. They are lighted by huge windows, which make the frontage nearly all of glass. The transmission lines leave the building from the top storey in three directions; each line, being a double one, carries accordingly six wires. The poles which carry the lines run six to the kilometre and are made of reinforced concrete and specially treated (injected) pine wood on the usual lattice design. The first line to Cagliari, the capital of Sardinia at the southern extremity of the island, is completed. It runs to a central transforming station at Guspini, where the voltage is reduced to 15,000 volts. It is connected at this point with the thermal plant of Porte Vesme, which is worked by Sardinian lignite and constitutes a reserve of 10,000 b.h.p.

Selfe] [*Clapton.*

An Electrical Engineer at Home (see p. 927).

The second line, under construction, runs to Sassari, the northern capital, and connects with the River Coghinas scheme mentioned above, which will provide another 9,500 continuous kW at the door of its power house.

The third line, destined eventually to connect with the River Flumendosa scheme (which represents the third stage of development), runs in a south-easterly direction, and is practically completed as far as Gadoni, close to which are situated the mines of the Monteponi Company, now in course of being opened up. These mines are being equipped with electrolytic plant, and will shortly be in a position to take 4,000 kW on a practically continuous load.

It is not easy to say yet what the output of the Tirso

An "All-Electric" Flat (see opposite page).

(Photographs by Selfe, Clapton.)

scheme will amount to in practice, as its completion is so very recent. The amount of water available for use is equivalent to a continuous flow of 20 cubic metres per second, but the power house, being situated inside the dam, will be operating with a very variable head. The maximum head is 57 metres (190 ft.). It is calculated, however, that 60,000,000 kilowatt-hours will be made available for sale annually—which supposes a mean head of about 46 metres (153 ft.). A load factor of 66 per cent., which is usually reached in Italy, would thus enable 40,000,000 kilowatt-hours to be actually marketed.

A small subsidiary plant, electrically connected of course with the above, is nearing completion a few kilometres further down the Tirso valley. The dam will be 17 metres high, and will form a small head reservoir. The b.h.p. installed will be 4,000. The base of the dam stands at a trifle over 100 ft. above sea level, and the water on discharge will continue in the bed of the river for a few miles—as far as the village of Truschedu—after which it will be again impounded into a small reservoir connected with the new irrigation canals.

This remarkably interesting scheme is very easily visited. Comfortable steamers run every night between Civitavecchia and Terranova, in Sardinia. Civitavecchia is but an hour and a half's run from Rome. Thus leaving Rome at 6 p.m., the Tirso dam may be reached by mid-day on the following day. Accommodation in Sardinia may always be relied upon to be clean, however simple; and it is exceedingly cheap.

A Modern Electric Flat.

By L. L. ROBINSON, M.Inst.C.E., M.I.E.E., Borough Electrical Engineer, Hackney.

TIME was when we lived in houses, heated by coal and lighted by gas or oil—when our servants lived in dungeons underground and spent their days removing debris and dirt—waste products of coal, gas and oil which cumbered the house.

Those were dark days which some of us still remember, though we would like to forget.

But with the coming of electricity, a new era has dawned. One of the great powers of nature has been tamed and harnessed and trained to the service of man, making life clean, wholesome and simple.

We can make electricity light our home, warm our rooms, cook our food, heat our bath water, wash our clothes and iron them, clean our carpets with a thoroughness no broom or silent sweeper has ever equalled, and leaving no debris or dirt whatever.

The servant in the house, that luxury still clung to by some "die-hards" as indispensable (the war made us all familiar with the elasticity of meaning of that word) is often the chief stumbling block in the path of those longing for a complete electric home.

They say: "One could never trust the servants—the bills would be enormous."

The same arguments were used when gas first supplanted coal for cooking and oil for lighting, yet the march of progress overruled them, and cooks were in the end entrusted with gas, as they can now be trusted with electricity.

The flat illustrated on p. 928 is a small one, but what it lacks in floor space is more than counterbalanced by its supreme comfort, cleanliness and efficiency, all of which are due to the fact that electricity is employed as the principal maid-servant.

The accommodation consists of:—

Hall and passage.	Bath room.
Single bedroom.	Servant's bedroom.
Sitting room.	W.C.
Double bedroom.	Kitchen.
Dining room.	

The rooms are all decorated with ivory white ceilings and friezes down to the picture rails, and from there to the skirtings with matroil distemper in harmonious light-reflecting autumn shades varying from primrose yellow to rustic brown.

These colours give particularly good effects when used in conjunction with metal-filament and gasfilled lamps.

The floors are covered with linoleum and Eastern rugs and carpets. Even the kitchen is treated in this way, because there is no mess with electric cooking.

The regular use of the vacuum cleaner has abolished the horror of spring cleaning entirely, because it is never necessary to take the rugs and carpets up or to take the pictures down.

Each bedroom has one pendant light with silk shade and frosted metal-filament lamp.

Each bed is fitted with an adjustable bed lamp and with a bedside kettle for the morning cup of tea. One three unit per hour Sullivan fire is used in each bedroom so that a comfortable temperature can be obtained in a few minutes before going to bed.

The sitting room is lighted either by a central semi-reflecting alabaster bowl fitting with a gasfilled lamp, or by two table standards with silk shades and frosted metal-filament lamps.

There are three 5-ampere switch plugs which can be used for the vacuum cleaner, table standards, sewing machine, violet-ray apparatus, &c., and there is one 15-ampere Santon switch plug for the 3 unit per hour Sunblaze fire, which is seldom used more than half on. One of the 5-amp. switch plugs near the window is used in very cold east-windy weather to warm the window draught with a half unit per hour Tricity "Baby" fire.

The dining room is lighted by an artistic Dutch fitting with candle fitments and by two candle-sticks on the sideboard. There is a 15-ampere Santon switch plug for the one-and-a-half unit per hour Sunblaze fire, and a half unit per hour Tricity "Baby" fire can be used to warm and turn up the window draught when necessary, or close to the four-valve wireless set which is attached to the wall in an odd corner of the dining room and wired through to a plug for the loud speaker in the sitting room.

The bathroom is supplied from the hot water tank in the kitchen, but is also fitted with a 4-kW Santon geyser over the basin and with a half unit per hour bowl fire. The lighting is by means of a frosted metal-filament lamp in a suitable Holophane shade.

The kitchen is equipped with a 20-gallon tank heated from an Ideal boiler which burns up the rubbish, or by a 2-kW Geo. Nobbs immersion heater, controlled by a Wilkinson thermostat so as to maintain the temperature of the water between 130 deg. F. and 160 deg. F. The light is provided by means of a 40-watt frosted lamp in a Holophane dispersing shade, and clothes are aired in the ceiling dryer fitted with carbon lamps in a galvanised iron wire cage—one of "Tricity's" latest domestic conveniences.

The cooking equipment consists of a table type Tricity cooker with two hot plates and a 200-watt plate warmer on top. There are in addition two 10-amp. switch plugs for supplying when necessary a 1,000-watt Swan 3-pint kettle, and a 1,500-watt Belling open-type boiling ring. There are also a 15-ampere Santon switchplug for use with a radiant fire when necessary, and a 5-ampere switchplug for the vacuum cleaner, sewing machine, flat iron, and last, but not least, in the opinion of an amateur wireless enthusiast, the electric soldering iron.

The occupants of the flat consist of two people who like lots of baths, a maid in three days a week, which is all that is necessary, and many visitors.

The electrical consumption works out as follows for a winter quarter:—

Fixed charge, based upon lamps installed	£0	16	0
Hot water—504 at 0.6d.	1	5	2½
General units—806 at 1d.	3	7	2
	£5	8	4½

Gas, indeed, would have been expensive even if supplied free!

A word about the fuse board. There is a general impression that the fuse board is sacred to the man in brass buttons, and that any uninitiated person may not lay a duster on it under penalty of a severe shock. This is quite a mistake. Turn off the main switch, and the fuse holders become quite innocuous, and should be attended to with the same regularity as all other cleaning. The dusting of fuses also makes one familiar with the very simple process of renewing the fuses, another dark mystery to the uninitiated.

Contracts Closed.

(*Continued from page 924.*)

Glasgow.—Watching and Lighting Committee. Recommended:—

Electrical fittings and accessories.—Wood & Cairns; Metropolitan-Vickers Electrical Co., Ltd.; W. Brown & Co., Ltd.; T. Land & Son; Edison Swan Electric Co., Ltd.; W. McGeoch & Co., Ltd.
Lamp pillars.—Carron Company.

Tramways Committee. Recommended:—

Brake blocks.—Miller & Co., Ltd.
Rubber and asbestos.—North British Rubber Co., Ltd.
Springs.—Turton Bros. & Matthews, Ltd.; West Bromwich Spring Co., Ltd.; L. Sterne & Co., Ltd.

Corporation. Accepted:—

Electric lifts for new buildings, Stockwell Street (£3,728).—J. Bennie, Ltd.

Electricity Committee. Supply of stores for 12 months:—Recommended:—

Cast-iron boxes, section pillars, &c.—Carron Iron Co.; Falkirk Iron Co.; D. King & Son; Lion Foundry Co.; McDowall, Steven & Co., Ltd.
Malleable iron tube and fittings.—Stewarts & Lloyds, Ltd.; Scottish Tube Co., Ltd.
L.p. cable.—Callender's Cable & Construction Co., Ltd.; Enfield Cable Works, Ltd.
H.p. cable.—Callender's Cable & Construction Co., Ltd.; W. T. Glover and Co., Ltd.
Rubber-covered cables and flexibles.—Craigpark Electric Cable Co., Ltd.
Meters.—Chamberlain & Hookham, Ltd.; Edison Swan Electric Co., Ltd.; Ferranti, Ltd.; Metropolitan-Vickers Electrical Co., Ltd.
Arc lamp carbons.—Beacon Carbons, Ltd.; General Electric Co., Ltd.

Cleansing Committee. Recommended:—

In connection with the erection of new refuse destructor at Govan (£382,150).—Heenan & Froude, Ltd.

High Wycombe.—Installing the electric lighting at Bledlow Schools:—

E. H. Milner (Accepted.)	**£204**
J. W. Tubbage & Son	208
J. R. Colston & Co.	227
Messrs. Hazell	228
Wycombe Borough Electric Light Co.	236
W. B. R. Garlick	250

London.—LONDON COUNTY COUNCIL.—Switchgear, &c., required for the new 15,000-kW turbine set at Greenwich power station:—

British Thomson-Houston Co., Ltd. (Accepted.)	**£7,027**
A. Reyrolle & Co., Ltd.	8,097
Bertram Thomas	8,326
Metropolitan-Vickers Electrical Co., Ltd.	8,422
Ferguson, Pailin, Ltd.	8,624
Johnson & Phillips, Ltd.	8,735
New Switchgear Construction Co., Ltd.	8,943
Switchgear & Cowans, Ltd.	9,141
Whipp & Bourne, Ltd.	9,144

Normanton (Yorks.).—Urban Council. Accepted, in connection with the electric lighting scheme:—

Cables (£7,038).—Union Cable Co., Ltd.
Transformers (£240).—Brush Electrical Engineering Co., Ltd.
Connections to transformers (£436).—Yorkshire Electric Power Co.
Switchgear (£269).—Metropolitan-Vickers Electrical Co., Ltd.
Sub-station (£750).—R. Leak & Son.

West Bromwich.—Board of Guardians. Accepted:—

Electric lighting installation at Hallam House (£3,310).—Whittaker Bros., Ltd.

Forthcoming Events.

Radio Society of Great Britain (Transmitter and Relay Section).—Friday, June 6th. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 6 p.m. Lecture on "Modulation Systems," by Capt. A. G. St. Clair Finlay.
Wednesday, June 11th. Informal meeting. At 6.30 p.m. "General Observations on the Radio Situation and the Development of Broadcasting in New Zealand," by Mr. A. H. Ninnis.

Association of Mining Electrical Engineers (South Wales Branch).—Annual meeting and conference. Tuesday, June 10th to Saturday, June 14th. St. Pancras Hotel.

Chemical Society.—Thursday, June 12th. At the Royal Institution, Albemarle Street, W. At 5.30 p.m. Faraday Lecture on "Atomism in Modern Physics," by Prof. R. A. Millikan, of the Californian Institute of Technology.

Physical Society of London.—Friday, June 13th. At 5 p.m. At the Imperial College of Science, South Kensington, S.W. Ordinary Scientific Meeting.

Notes.

Local Societies.—WORKS VISIT.—A visit of the Manchester Association of Engineers to the works of the Vulcan Foundry, Ltd., Newton-le-Willows, took place on May 29th. The President of the Association, Mr. H. Bates, and about 130 members attended. The company has just completed an order for twenty goods engines and tenders for the Bengal Nagpur Railway, and is now commencing the delivery of twenty tank locomotives for the London, Midland & Scottish Railway, Derby Section. One of these tank locomotives was seen in steam under test during the visit. At the close of the visit tea was served to the party.

ELECTRICITY IN MINING.—Mr. J. C. Stewart read a paper on "The Efficiency of Electricity in Mining Machinery" at a recent meeting of the West of Scotland Branch of the Association of Mining Electrical Engineers in Glasgow. He dealt in detail with the methods of improving power factor and increasing efficiency and emphasised the necessity for proper maintenance.

RADIO CONDENSERS.—At a recent meeting of the Croydon Wireless and Physical Society, Mr. Philip R. Coursey, B.Sc., delivered a lecture accompanied by lantern slides on the construction of a well-known type of mica condenser. He explained that great skill was required in splitting the mica, the thickness of which was measured mechanically and to a very high degree of accuracy. Each plate was visually inspected for obvious defects, and was also electrically tested, by means of electric sparks, to eliminate non-obvious defects. The mica and tin-foil plates were impregnated with wax in a vacuum and tested for capacity, breakdown, and insulation resistance. If the condenser was sound a tone or hum was heard while it was under electrical test, but if it was unsound a click was heard. Tests were rendered all the more necessary because mica was a raw, and not a manufactured, material.

Report upon Railway Accident.—Major G. L. Hall has reported to the Ministry of Transport upon the accident which occurred to an electric train at Southport (L.M.S. Railway) on March 9th. From the evidence taken at the inquiry it appears that derailment of a coach resulted from the mounting of the wheels on a considerable curve due to defective track. The Inspector is of the opinion that more complete checking is desirable along the inside rail of a turn-out at a running junction where the curvature is so pronounced, and he also thinks that the company should consider whether the maintenance gang on this part of the system is adequate.

The Redding Colliery Disaster.—In his report on the Redding Colliery disaster, in which 40 men lost their lives, Sir Thomas H. Mottram, Chief Inspector of Mines, refers to the need for the placing of more telephones in the mines at shorter distances as a point worth the consideration of mine owners from a safety and economic standpoint.

Radio Traffic Control.—Scotland Yard made elaborate arrangements for dealing with the traffic to Epsom on Derby Day. Two control vans fitted with wireless sending and receiving sets, built from police designs at the Putney garage of the Metropolitan Police, patrolled the main routes to the racecourse. The vans can receive and send messages in a special code devised for the occasion while travelling at 40 miles an hour. An observation balloon was used this year instead of an aeroplane for picking out the congested spots and signalling to the wireless control vans. The observers in the balloon were in direct communication with a wireless station on Epsom Downs adjoining the office of the traffic controller. All important traffic points were connected up by telephone.—*Daily Mail.*

Educational.—FRANCE.—A joint stock society has been formed in Paris to "foster the development of higher education in electrotechnics in France," her colonies and protectorates, and more especially to give financial and administrative support to the Société Francaise des Electriciens for the extension of the operations of the Ecole Supérieure de l'Electricité and of the Laboratoire Central d'Electricité. The capital of the society is 5,000,000 fr. in 1,000 fr. shares subscribed in cash. The first administrators of the society consist of 20 of the leading electrical and electrotechnical undertakings of Paris and the provinces.

High Speed Kinema.—The most rapid kinema pictures ever shown to the public, taken at speeds varying from 18,000 to 20,000 photographs a second, were recently exhibited at the Royal Institution by M. Lucien Bull, Sub-Director of the Institut Marey, in Paris. At the outset of the lecture he explained how the first pictures had been taken by the late Prof. Marey, but though valuable for scientific purposes were useless for the public, as they were unsuitable for projection. Then followed a host of figures and calculations. The highest speed that could be attained if the film was stopped for each

exposure was 300 per second. A scientific instrument had been invented and was used by the British Admiralty that weighed four tons, in which the lens and the film both revolved, so that they were relatively stationary. By this means a speed could be reached in which the exposure would last only 1-200,000th of a second, a useless result if sunlight was employed, because no film could respond to sunlight at that short time of exposure. Fortunately the electric spark came to the aid of the scientific photographer.—*Morning Post.*

Appointments Vacant.—Jointer for the Wimbledon Corporation Electricity Works. Engineer to take charge of the distribution system of the Pietermaritzburg-Glencoe section of the S.A. Railways and Harbours electrification scheme. Lady demonstrator of electrical cooking and other domestic apparatus for the Birmingham Electricity Supply Department. Assistant station superintendent (£506), and repairs engineer (£408), for the Hammersmith Borough Council Electricity Department. Two switchboard attendants for the Borough of Bermondsey Electricity Department. Junior electrical laboratory assistant in H.M.S. *Vernon*, Portsmouth. (See our advertisement pages to-day.)

Fires.—There was an outbreak of fire, on May 20th, in a wooden structure at the rear of Nelson House, Burnley, owned by Mr. Cecil Greenhalgh, and used for storing electrical appliances and wireless apparatus. The building was completely gutted and a considerable amount of damage was done to the electrical appliances, &c.

As the result of a fire at the pithead of No. 7 Pit Callendar, owned by the Callendar Coal Company, Ltd., Falkirk, the pithead gear and screening apparatus were totally destroyed.

Telephone Users' Protection Association.—The Telephone Users' Protection Association was brought into being at a meeting at the House of Commons on May 28th, Major Leslie Hore-Belisha, M.P., presiding. A preliminary committee was appointed, with power to add to its number, and it was decided that until further notice the minimum subscription should be 5s. in the case of private users and 10s. in the case of business users. Major Leslie Hore-Belisha, M.P., was appointed president, Mr. Stanley J. Rubinstein organising secretary, Mr. R. F. W. Fincham hon. treasurer, and Mr. Ronald Rubinstein hon. secretary. It was decided to circularise telephone subscribers, pointing out that the methods of the association would be a systematic examination into the causes of dissatisfaction with the service and an attempt to co-operate with the Post Office in an endeavour to remedy each of the evils found to exist. So far as London is concerned, a somewhat similar body already exists in the London Telephone Advisory Committee, which has its offices at, and is staffed by, the London Chamber of Commerce.

Institution Notes.

Institution of Electrical Engineers.—NORTH-WESTERN CENTRE.—The report of the Committee for 1923-24 shows that 11 meetings have been held, the attendance varying from 200 to a minimum of 50, an average of 115 per meeting throughout the session, as against 120 last year. The two informal meetings have again proved attractive; the discussions have been fairly well maintained, the number of speakers during the session being 59, an average of 7.4 per meeting, the same as last year. Mr. J. Frith, the hon. treasurer, has introduced an ingenious arrangement to help the Benevolent Fund, the *modus operandi* of which, the Committee hopes members will frequently test with the coin in the slot. The membership for the Centre is 1,023, an increase of 58.

Institute of Transport.—ANNUAL CONGRESS.—The Institute held its annual congress at Bristol from May 28th to 31st. Papers were discussed, and visits were paid to the Avonmouth Docks, the City of Bath, the works of Messrs. Stothert and Pitt, and the grounds of the Bath Electric Tramways, the Great Western Railway works at Swindon, the Bristol Aerodrome at Filton, the works of Messrs. J. S. Fry & Sons, Ltd., and the Severn waterways from Sharpness to Worcester. The social functions included a conversazione by the Lord Mayor and Lady Mayoress of Bristol, a luncheon by the Mayor of Gloucester, a reception by the Mayor of Bath, and a garden party at Clifton by invitation of the Local Congress Committee.

Association of Consulting Engineers.—ANNUAL MEETING.—The tenth annual general meeting of the Association of Consulting Engineers (Inc.) was held on May 26th, under the chairmanship of Col. J. Mitchell Moncrieff, C.B.E., M.Inst.C.E., who presented the report of the Committee for the year ended April 30th, 1924, pointing out that one of the most satisfactory features of the year was the increase in membership; 22 new members were elected (and four others since the report was completed), making the total number 103. He did not think that consulting engineers, outside the Association at any rate, realised how important it was that they should be members. They were not at all disloyal to the Institutions of Civil, Mechanical, or Electrical Engineers, in existing as a separate association. Of the members of the new Council of the Institution of Civil Engineers, 31 members, eight people in this country were regular consulting civil engineers in one form or another. They could not expect to get the same attention paid to the interests of their professional life under those circumstances as they ought to get in their own Association. There was a still smaller proportion of purely consulting engineers on the councils of the other bodies.

Last year they had before them at the general meeting the question of rules and scale of fees. That was all gone into by a committee this year, and they were justified now in claiming that the rules were in a very satisfactory condition and that they could rely upon them in professional dealings with clients generally.

The report records the fact that in November last, as the result of the protest made by the Association and others to the British Engineering Standards Association, the Sectional Electrical Committee had sent an instruction to the various panels that:—"The British Engineering Standard Electrical Specifications should be so drawn up as to include the technical requirements necessary for the provision of the material, plant and apparatus herein referred to, and should not include other matter."

During the year considerable use has been made of the standard conditions of contract for export drawn up last year by the Association. They appear to have met with general approval, only one or two minor alterations having been suggested, some of which it is proposed to embody in the next reprint. A large number of applications were received during the year from official bodies and private persons for lists of members specialising in different branches of engineering, and for information as regards the charges and professional practice of members. Local authorities which had advertised for the services of consulting engineers have had the fact pointed out to them that no member of the Association, nor indeed any engineer of repute, would reply to such advertisements.

During the year arrangements have been made with the Department of Inland Revenue by which members are entitled, when making up their returns for income tax, to deduct the amount of their subscription to the Association. The Association is represented on 28 different committees.

The report was adopted unanimously, as were also the accounts, which were presented by Mr. S. R. Lowcock, who called attention to the fact that they were a little better off than last year. They did not wish to make a profit; after paying expenses, which amounted to £392, they were £27 to the good. That, added to what they had last year, namely, £81, made £108 altogether. They had cash at the bank and £100 war stock, which they had put down at cost, namely, £88.

The new members of the Committee for 1924 were elected as follows:—*London members*: Mr. C. G. Du Cane, Mr. Cyril Hitchcock, Mr. J. M. Kennedy, and Mr. A. M. Sillar. *Country members*: Mr. J. W. Goldson (Newcastle-on-Tyne) and Mr. E. J. Silcock (Leeds).

Votes of thanks were accorded to the hon. solicitor, Mr. F. E. Wright, to the hon. auditors, Messrs. Cash, Stone and Co., and to the chairman.

Mr. Sidney R. Lowcock, of 6, Queen Anne's Gate, S.W.1, has been elected chairman of the committee for the ensuing year.

Our Personal Column.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

The following appeared in *The Times* "Personal" advertisements on May 29th:—"WHEATSTONE, Sir CHARLES (the late).—Nearest relative or personal representative kindly communicate with W. Bellows, Tuffley Lawn, Gloucester."

Ilford Urban Council has increased the salary of the tramway manager from £735 to £810 per annum.

Mr. J. NIXON, chief road inspector of the Wallasey tramways undertaking, has retired after 23 years' service. His colleagues presented him with a gold watch.

West Ham Town Council has increased the salary of the electrical engineer, Mr. F. W. PURSE, to £1,695 per annum, as from April 1st last. His previous salary was £1,000, plus £334 bonus.

Mr. HENRY WALKER, C.B.E., Deputy Chief Inspector of Mines, has been appointed Chief Inspector of Mines in succession to Sir THOMAS MOTTRAM, C.B.E., who will retire on June 20th, at the age of 65. Mr. FREDERICK HORTON WYNNE, Divisional Inspector of Mines, York and North Midland Division, has been appointed Deputy Chief Inspector in succession to Mr. Walker.

Mr. R. C. HALL, of Robertson, Cape, South Africa, took up the appointment of municipal electrical engineer at Riversdale, Cape, South Africa, on June 1st.

It is recorded in the Sydney newspapers that Mr. JOHN MILWARD, manager in the Pacific of the Pacific Cable Board, entered on leave in April, prior to retirement after 22 years in the service of the Board. He was returning to London, "where," one report adds, "no doubt his expert advice will still be sought by the Board in an advisory capacity." Before the Pacific cable was laid he was in the employ of the Eastern Company.

The London County Council Highways Committee recommended that Major P. CROOM-JOHNSON, resident engineer for the Minister of Transport, and Mr. A. S. YOUNG, permanent-way engineer's department, Glasgow Corporation Tramways, be appointed assistant permanent-way engineers in the London County Council's Tramways Department at a commencing salary of £500 a year (based on pre-war conditions), the total remuneration at the present time being at the rate of £696 per annum.

On Friday last, at the invitation of the Electrical Press, Ltd., the colleagues and other friends of Mr. A. GOWANS WHYTE took part in a complimentary dinner at the Connaught Rooms to that gentleman, who has resigned the post of chief editor of the company's publications in order to join the organising staff of the Conservative party under Mr. H. E. Blain, C.B.E. Proposing the health of Mr. Whyte, Mr. E. Garcke spoke of the high esteem in which he had been held by the directors throughout his 23 years' service, and of the extraordinary ability and versatility which he had displayed, and presented him with a gold watch, together with a handbag for Mrs. Whyte, as a token of their regard. Mr. Blain supported the toast, paying a tribute to the qualities of the guest, who, in response, expressed his profound appreciation of the kindness which he had experienced on all hands, especially from Mr. Garcke and Mr. W. M. Madgen. Mr. H. B. Atkinson proposed "The Electrical Journals," and Mr. T. C. Elder the health of the chairman. Mr. Whyte's successor is Mr. W. L. Randell, editor of *Electrical Industries*, to whom, as well as to Mr. Whyte, we tender our good wishes.

Mr. S. M. HILLS has resigned his position as manager of the engineering department of Greenlys, Ltd., and accepted an appointment with the Electrical Press, Ltd.

Col. R. E. B. CROMPTON, C.B., was the guest of the evening at the dinner given by old Cromptonians on May 31st ult., at the Royal Automobile Club, to commemorate his 80th birthday. Mr. A. A. Campbell Swinton, F.R.S., chairman of Messrs. Crompton & Co., Ltd., gave some interesting reminiscences of his first meeting Col. Crompton at Chelmsford during some projector tests for Chilean ships, built by Sir W. G. Armstrong, Whitworth & Co. A silver salver was presented to Col. Crompton, with a suitable inscription, from a number of old Cromptonians. Mr. Campbell Swinton stated that the directors of Messrs. Crompton & Co., Ltd., had decided to form an old Cromptonian Society, and a committee, consisting of Messrs. J. Swinburne, E. Reeves, E. J. Fox, A. E. Mohring, and C. S. Peel (as hon. secretary) would meet immediately to discuss the possibility of the first meeting at a luncheon at Crompton's Works at Chelmsford. Some remarks were made by Mr. A. P. Lundberg, who was Crompton's first employé, and who is 91 years of age; also by Mr. S. Baynes, who was the second employé; Mr. Charles Crompton, the chairman of the Stanton Ironworks; Messrs. E. J. Fox, C. S. Peel, J. W. Meares, C. F. Tufnell, S. Mavor, and A. Williams.

Birthday Honours.—In the list of Birthday Honours announced on Tuesday last the following appointments are made:—Mr. GERALD BELLHOUSE, C.B.E., Chief Inspector of Factories to the Home Office, receives the honour of knighthood. Sir CHARLES SCOTT SHERRINGTON, G.B.E., President of the Royal Society, is appointed to the Order of Merit. Mr. R. A. DALZELL, C.B.E., Director of Telegraphs and Telephones, G.P.O., is made a C.B. (Civil Division). Mr. W. J. BRAMWELL, lately telegraph engineer, Post and Telegraphs Department, Gold Coast, becomes an M.B.E. Mr. W. SUTHERLAND, Chief Engineer, Indian Telegraphs, is made a C.S.I. Mr. ROBERT DONALD, the chairman of the Empire Press Union, and chairman of the Empire Wireless Committee which recently reported to the Government, receives the distinction of G.B.E.

Obituary.—MR. F. TETT.—The death took place, on May 30th, at the age of 74 years, of Mr. Frank Tett, senior director of the firm of Henry S. Tett & Co., Ltd., electrical engineers, of Faversham and Sittingbourne. During the previous evening, whilst going round the premises at the Preston Works, he stumbled over a protecting wall into a pit in the yard, and sustained a broken neck. He was found dead the next morning by workmen.

Will.—The late Sir H. V. KILVERT, deputy-chairman of the Lancashire Dynamo & Motor Co., Ltd., left £145,798 gross, and £123,217 net personalty.

New Companies Registered.

Glasgow Engineering Supplies Co., Ltd. (13,182).—Private company. Registered in Edinburgh May 24th. Capital, £2,500 in £1 shares. To carry on the businesses of electricians, electrical and mechanical engineers, lamp manufacturers, tinsmiths, coppersmiths, brassfounders, &c. The subscribers (each with one share) are:—Captain W. J. Bean, 157, Broomhill Drive, Glasgow, W., chartered civil engineer; C. A. A. Muir, 30, Moray Place, Glasgow, engineer. The first directors are not named. Registered office: 49, St. Vincent Place, Glasgow.

W. E. Holloway, Ltd. (198,220).—Private company. Registered May 26th. Capital, £1,000 in 800 preference shares of £1 each and 4,000 ordinary shares of 1s. each. To carry on the business of manufacturers, importers and exporters of electrical and mechanical apparatus of all kinds, more particularly pertaining to wireless telegraphy, telephony, and television, &c. The first directors are:—W. E. Holloway, 63, Newman Street, W.1, wireless engineer; H. Clifton, address not stated. Qualification: 1 share. Registered office: 63, Newman Street, W.1.

Croydon Engineering Co., Ltd. (198,257).—Private company. Registered May 28th. Capital, £10,000 in £1 shares. To acquire all or any of the assets of the business lately carried on at Gloucester Road, Croydon, Surrey, as "Scholey & Co., Ltd.," and to carry on the business of electrical, mechanical, and telegraph engineers and contractors, engine builders, boiler makers, electricians, manufacturers of, and dealers in dynamos, engines, boilers, telegraphic, telephonic, and wireless instruments, wires, cables, insulators, &c. The first directors are:—A. L. Muirhead, "Mayfield," Manor Way, Beckenham, Kent, telegraph engineer; F. H. Muirhead, address not stated; C. F. C. Wilkins, "Porleck," Addiscombe Road, Croydon, electrical engineer; H. A. Harrison (managing director), address not stated. Qualification, £50 shares. Remuneration as fixed by the company. Solicitors: Farrar, Porter & Co., 2, Wardrobe Place, Doctor's Commons, E.C.4.

Holbrook's Electric Service Co., Ltd. (198,117).—Private company. Registered May 22nd. Capital, £1,000 in £1 shares. To carry on the business as indicated by the title. The first directors are:—A. E. Snelling, 44, Kelvin Avenue, Palmer's Green, N., departmental manager to wholesale textile merchants; E. E. Morris, 58, Palmerston Crescent, Palmer's Green, N., counting house manager to wholesale textile merchants; J. R. Holbrook, 35, Dalmally Road, Croydon, electrical engineer. Solicitors: Hatchett, Jones & Co., 48, Mark Lane, E.C.2. Registered office: 1, Foster Lane, E.C.

Norwood Wholesale Fittings Supply Co., Ltd. (198,108).—Private company. Registered May 22nd. Capital, £1,000 in £1 shares. To carry on the business of factors and brokers of, agents for, and dealers in wireless sets, parts, gramophones, electrical fittings and goods, and accessories of all kinds, &c. The first directors are:—J. Bolsom, 123, Westminster Bridge Road, S.E., manufacturer's agent; C. Slater, 40, Cromwell Road, Forest Gate, E., electrical engineer. Qualification, 25 shares. Registered office: 71, High Street, South Norwood, S.E.

A. Southern & Co., Ltd. (198,113).—Private company. Registered May 22nd. Capital, £1,500 in £1 shares. To take over the business of electrical engineers carried on by G. W. Holt, Florence J. Holt, Dorothy A. Holt, and A. Southern at Manchester Road Station, Manchester Road, Bradford, as A. Southern & Co. The permanent directors are:—G. W. Holt, 33, Southfield Lane, Little Horton, Bradford, grocer; Mrs. F. J. Holt, 33, Southfield Lane, Little Horton, Bradford; Miss D. A. Holt, 33, Southfield Lane, Little Horton, Bradford; A. Southern, 26, Hastings Terrace, Bankfoot, Bradford, electrical engineer. Qualification, 25 shares. Remuneration as fixed by the company. Secretary: Dorothy A. Holt. Solicitor: R. E. Weatherhead, 17, Piccadilly, Bradford. Registered office: Manchester Road Station, Manchester Road, Bradford.

Hardman & Co., Ltd. (198,202).—Private company. Registered May 26th. Capital, £500 in £1 shares. To acquire the business carried on by R. Hardman, F. Grindrod, and Lucy Grindrod at the "Tower," 68-70, Yorkshire Street, Rochdale, and to carry on at Rochdale and elsewhere the business of an electric light company in all its branches. The first directors are:—R. Hardman, 101, Mitchell Street, Rochdale, electrical appliance factor; F. Grindrod, 56, Rowley Street, Rochdale, electrical appliance factor; Mrs. L. Grindrod, 56, Rowley Street, Rochdale. Qualification, £100. Solicitor: S. L. Coupe, "Greenway," Bagslate Moor Road, Norden, near Rochdale. Registered office: 68-70, Yorkshire Street, Rochdale.

Official Returns of Electrical Companies.

British Electric Transformer Co., Ltd.—Land Registry charge on 48, Oxford Street, W., dated May 9th, 1924, to secure £20,000. Holder: F. Smith, 2, Clarence House, Regent's Park, N.W.

Orlings Telegraph Instruments Syndicate, Ltd.—Issue on April 28th, 1924, of £50 debentures, part of a series already registered.

Mersey Power Co., Ltd.—Satisfaction in full on May 10th, 1924, of mortgage or charge by way of trust deed, dated October 31st, 1921, securing £300,000 debenture stock.

Car Ignition and Lighting Co., Ltd.—J. P. Cave, of 1, Milton Road, Highgate, N.6, ceased to act as receiver on May 14th, 1924.

Nalder Bros. & Thompson, Ltd.—Land Registry charge on freehold land and buildings, 95, 97, and 97a, Dalston Lane, 56 and 57, Ridley Road, and land at back of 44-55, Ridley Road, Hackney, dated May 19th, 1924, to secure all moneys due or to become due from company to Midland Bank, Ltd.

Northern Auto Electric Services, Ltd.—Debenture charged on the company's undertaking and property, including uncalled capital, dated May 13th, 1924, to secure all moneys due or to become due from the company to the Union Bank of Manchester, Ltd.

Transit Co., Ltd. (109,799).—Return dated March 14th, 1924. Capital, £5,000 in £1 shares. 4,055 shares taken up. £1 per share called up on 1,955 and 6s. per share on 2,100 shares. £2,585 paid. Mortgages and charges, nil.

Return of allotments made up to May 8th, 1924, shows a further 45 shares allotted payable in cash.

Cambridge Electric Supply Co., Ltd. (36,457).—Return dated March 12th, 1924. Capital, £100,000 in £10 shares. All shares taken up. £100,000 paid. Mortgages and charges, £75,000.

City of Buenos Ayres Tramways Co. (1924), Ltd. (82,214).—Return dated February 27th, 1924. Capital, £1,240,000 in £5 shares. All shares taken up. £1,240,000 considered as paid. Mortgages and charges, £174,000.

Central Electric Supply Co., Ltd. (53,080).—Return dated February 26th, 1924. Capital, £100,000 in £5 shares. All shares taken up. £100,000 paid. Mortgages and charges, £1,300,000.

Tubes, Ltd. (91,224).—Return dated November 13th, 1923 (filed January 1st, 1924). Capital, £150,000 in £1 shares. All shares taken up. £1 per share called up on 82,859 and 10s. per share on 49,450 shares. £107,584 paid. £42,416 considered as paid, being £1 per share on 17,691 and 10s. per share on 49,450 shares. Mortgages and charges, nil.

Gosport and Alverstoke Electric Lighting Co., Ltd. (82,693).—Return dated January 11th, 1924. Capital, £35,000 in £10 shares. 2,500 shares taken up. £25,000 paid. Mortgages and charges, nil.

Perfect Burglar Alarm Co., Ltd. (112,522).—Return dated December 11th, 1923. Capital, £4,000 in 1,000 pref. and 3,000 ordinary shares of £1 each. 230 preference and 1,710 ordinary shares taken up. £1 per share called up on 1,210 and 15s. per share on 230 shares. £1,382 10s. paid. £500 considered as paid on 500 shares. Mortgages and charges, nil.

Sterling Telephone and Electric Co., Ltd.—Mortgage and floating charge on certain properties at Dagenham and Westcliff-on-Sea, and the company's undertaking and property, present and future, including uncalled capital, dated May 15th, 1924, to secure all moneys due or to become due from the company to Barclay's Bank, not exceeding £100,000.

Mexico Electric Tramways, Ltd. (56,932).—Return dated December 31st, 1923 (filed April 4th, 1924). Capital, £1,000,000 in 500,000 preference and 500,000 ordinary shares of £1 each. All shares taken up. £500,000 paid on the preference and £500,000 considered as paid on the ordinary shares. Mortgages and charges, £709,500.

City Notes.

Siemens Brothers and Co., Ltd.

The 43rd annual general meeting was held on May 28th at the Central Hall, Westminster. Mr. G. Mure Ritchie, who presided, first referred in great detail to the balance sheet. Continuing, he said he wished to emphasise the fact that neither the considerable capital expenditure of 1922 nor the larger capital expenditure of 1923, cumulatively no less than £400,000, nor any further payment for E.P.D., had required, or was likely to require, any further issue of shares or any addition to the debenture debt. Their relations with their workpeople continued friendly. On June 1st, 1923, there were 3,300 persons employed in the works; on December 31st, with the expansion of business, especially in the later months of the year, they had risen to 5,300, and to-day they numbered approximately 6,000. During the year they had provided additional buildings and machinery at Woolwich. The more important were an extension of the factory in which telephone cables were manufactured, thereby adding fully 50 per cent. to their productive capacity for that class of work; and an entirely new shop for lead-covered paper cables for super-tension voltage. Additions had also been made to and rearrangements effected in the telephone department, providing for machinery of the latest design in order to keep abreast of the continually increasing demand for that class of work. Last year he told them that their business generally seemed to show signs of expansion, and he also indicated a belief that the revival in demand then beginning would probably increase and be followed sooner or later by better prices. Those expectations had been fully realised as regarded the volume of orders received in 1923, approximately of £3,000,000, against £1,700,000 in 1922, but owing to competition prices under contracts completed in 1923, though showing an improving tendency, were not commensurate with the larger order book. He also expressed the opinion at the last meeting that the placing of certain large contracts for submarine telegraph cables could not be indefinitely delayed, and subsequent events had justified that opinion, substantial orders having been given out in 1923, of which they secured a fair share. Early in the year they secured a contract from the Commercial Cable Co. for a section comprising 1,000 nautical miles of their trans-Atlantic cable, and the section was manufactured and laid last summer. Following that they secured from the U.S. Government a large contract comprising about 2,000 nautical miles of cable destined to link up their western States with Alaska. That contract was obtained in the face of most severe competition, and obviously it could not have been secured had they not possessed a highly scientific and efficient productive organisation. Last year they also secured from the British Government a contract for another submarine telegraph cable comprising about 1,700 nautical miles, destined to extend the Imperial cable system by linking up various points in the British West Indies with the mainland in British Guiana. Regarding submarine telephone cable, telephonic communication with the Continent had been increasing to such an extent that engineers on both sides of the Channel had recognised for some time past that a radical change would require to be made in the type of under-sea cable in order to allow a larger number of conversations to be carried on simultaneously than had hitherto been possible. The question necessitated an entirely new departure in cable practice, and involved much scientific research and experiment, as well as considerable risk, in accepting novel and stringent conditions, but in view of the fact that the new type of cable would probably supersede that hitherto used, and also that it would probably create a demand in other parts of the world, every effort was made to secure the first contract placed in this country. They did secure that first contract, comprising 84 nautical miles of cable, and they commenced to manufacture it last year.

Having referred to the successful launching of the new cable ship *Faraday* on February 16th last, which, he said, was not outclassed by any ship of the kind afloat, he said that with regard to underground power cables, although schemes for railway electrification were not advanced to the stage of making contracts for power mains, nevertheless the general requirements of that class of cable were greater than for several years past, the value of the orders received having exceeded that of 1922 by over 20 per cent., while their output was correspondingly augmented. Of the underground telephone cables installed during 1923 he need only mention the trunk line connecting Edinburgh with Jedburgh, and another linking Nottingham to Newark. They had received contracts from the Post Office for the trunk telephone exchange at Sheffield, which was one of the largest of its kind in the kingdom, and, what was much more important, they secured a contract for the equipment of the Sheffield area with nine automatic exchanges; also automatic exchanges for Port Elizabeth and Pietermaritzburg in South Africa, and Brisbane in Australia, besides an extension of the automatic exchange with which last year they equipped Winnipeg.

With regard to the future, speaking generally, prospects for 1924 were good in respect of volume of orders, which were now being accompanied by better prices. In submarine work, during the current year their shops had been busy. In underground power cables and underground telephone cables the demand was good, and those departments were fully occupied with the execution of existing contracts. In the telephone department, and especially as regarded automatic telephones, the work now being turned out was in greater volume, and the prospects were better than ever before.

Lord Queenborough seconded the motion for the adoption of the report, which, after some discussion, was carried.

A long discussion ensued on the proposal to re-elect Mr. H. J. Thomas as a director.

The chairman stated, in reply to questions, that Mr. Thomas had been ill, and had not been able to give the usual amount of time to his duties, but they considered him a most valuable director.

On a show of hands the reappointment of Mr. Thomas was negatived by a large majority.

The chairman, after consulting with his colleagues, announced that he would not use the proxies which he had to carry the proposal, but he intimated that the board would consider themselves free to re-elect Mr. Thomas as a colleague on his restoration to health.

A further discussion took place on a proposal to pay to the directors who are also directors of the Caxton Electric Developments, Ltd., a sum of £1,000 a year to the chairman, and £500 per annum to each of the other directors, free of income tax. On a show of hands an amendment to reduce the amounts in each case by 75 per cent. was carried, but on a poll this was defeated and the original proposition was carried, the voting being 424,865 in favour and 1,500 against.

Isle of Thanet Electric Tramways and Lighting Co., Ltd.

A meeting is called for to-day, Friday, to pass a resolution dealing with the arrears on the preference shares as from 1910 and to alter the name of the company to the Isle of Thanet Electric Supply Co., Ltd. Though the earnings have for some years past shown substantial increases, it has not been possible, owing to capital expenditure, to satisfy the arrears due to the holders of preference shares. These at September 30th last amounted to approximately £99,000, less income-tax. The directors recommended a scheme of arrangement which will improve the financial position of the company and facilitate the provision of the funds necessary for the extension of the business. It is proposed that the deficiency of dividend accrued to September 30th, 1923, on the existing preference shares shall be cancelled and satisfied by the allotment to the holders of new preference shares, credited as fully paid, to the extent of 40 per cent. of their present holdings (*viz.*, two additional £1 shares for each £5 share now held), that the rate of dividend on the preference shares shall be increased as from October 1st, 1923, from 5 per cent. to 6 per cent., and that the preference shares shall, in addition, be entitled to rank for dividend equally with the ordinary shares in any year in which the latter receive more than 6 per cent. At a meeting called for June 27th a resolution will be proposed to capitalise £60,000, part of the undivided profits, standing to the credit of the general reserve account, the same to be applied in paying up preference shares of the company to the nominal amount of £60,000, the directors being authorised to distribute the said shares so fully paid up in the proportion of two shares for every five preference shares now held in respect of the amounts due for dividend from August 1st, 1910.

Great Northern Telegraph Co., Ltd., of Denmark.

The directors' report for the year 1923 states that the working of the Vladivostock, Kiachta, and Helampo routes has exceeded expectations. The Russian Government has kept the lines in good condition, placed spare lines at the company's disposal during interruptions and traffic blocks, and generally co-operated with the company. The correspondence exchanged terminally with Russia, *via* the company's cables, has also shown a satisfactory increase. The Danish Government has promised the extension of the company's concession until the end of 1944. The British Government has agreed to a prolongation of the company's landing rights for a period of ten years, and to a re-arrangement of the working agreements. The chief point of the new arrangement is the right given to the company, throughout England, to enter into direct relations with the public through its own offices, and in co-operation with the Eastern Telegraph Co.; formerly the company had dealings with the public in London only. By virtue of this arrangement a public office has been opened at Newcastle, and it has also been arranged that the Eastern Telegraph Co., whose interests in many places run parallel to those of the company, will handle the Scandinavian, Finnish, and Baltic traffic from London, Glasgow, Edinburgh, Dundee, Hull, Leeds, Bradford, Manchester, Liverpool, Birmingham, Bristol, and Cardiff. On the other hand, the company now deals with the traffic which the Eastern Telegraph Co. used to collect and deliver through its own office at Newcastle. An arrangement has been negotiated with the Swedish Government, according to which the company is allowed to transact business in Sweden until the end of 1934 on similar, though somewhat harder, conditions. The negotiations with China have not developed satisfactorily. Negotiations have been re-opened, but the company has had to protest against actions on the part of the Government which threaten to violate certain long-established rights. Future difficulties may arise in connection with the co-operation between the Chinese and Japanese Governments with regard to the telegraphic connection between the two countries. The report

states that radio competition has increased, and rates had to be adjusted to meet this. So far the company has not met with radio competition in the Far East, but mention is made of a concession made by the Chinese Government to a Japanese firm to enable it to construct a powerful station near Peking.

The traffic receipts showed an increase of about £72,900, and the total receipts rose by approximately £92,600. The total expenditure increased by £44,100. A dividend and bonus of 22 per cent. is recommended, and it is proposed to place £33,333 to the reserve and renewal fund (making it £3,359,294), and to carry a balance of £312,078 forward. The meeting is to be held in Copenhagen on June 12th.

Calcutta Tramways Co., Ltd.

Mr. J. G. B. Stone presided at the annual meeting on May 27th, and in presenting the report and accounts (*vide* ELEC. REV., May 23rd, p. 853), referred to the death of Sir Henry Kimber, for forty years a director of the company. Turning to the accounts, he said that the capital expenditure had been increased by £30,060, due principally to the balance of the cost of 25 new trains and distributing cables, less the cost of the balance of the d.c. plant rendered obsolete. The extra trains had enabled the services to be reorganised and increased. The Howrah system showed continued improvement in the volume of traffic. They did not consider the revenue results from the motor 'buses satisfactory, although the system had proved of great benefit to the public. As stated in the report, the company had a representative upon the committee which had been appointed to study the problems of the Calcutta traffic. The committee would make recommendations with regard to the further development of the company and the improvement of existing services. The company was working in close co-operation with the Improvement Trust, and in this connection sanction had recently been obtained for an extension into the Karaya district, with the immediate object of erecting a new car shed to facilitate the working of that part of the system. Referring to the current year, the chairman said that there had been an aggregate increase of 553,859 rupees in the receipts, and although this was compared with the strike period of 1923, the result reflected the steady growth of the company's business.

Shanghai Electric Construction Co., Ltd.

The annual meeting of the company was held on May 28th. Sir Alfred Dent (chairman), who presided, said that the growth of the company's business in Shanghai should have resulted in a far greater increase in the profits, but it was neutralised to a large extent by the depreciation of subsidiary coinage. Material sums had been absorbed by capital expenditure and renewals; renewals would continue to be heavy for some time to come. The fares were revised in January last to offset the loss due to depreciation of subsidiary coinage, and the result was immediately apparent. Although they carried fewer passengers, there was an appreciable increase in effective receipts, and the operating profit had improved each month since. The chairman then referred to the negotiations with the Shanghai Municipal Council for a concession to extend the system under railless traction. As stated in the report, the agreement was not signed until May 17th (this year). In conclusion, the chairman dealt with the proposed issue of 100,000 new shares, and the reconstruction of the Singapore Electric Tramways, Ltd., both of which matters were referred to in the report, which was abstracted in our last issue (p. 892).

Mr. J. S. Haskell seconded the adoption of the report, and after this had been carried, said that he regretted that Sir Alfred Dent was retiring from the board after his many years of fruitful work for the company. Mr. L. W. Hawkins was elected a director in Sir Alfred Dent's stead.

A resolution to increase the capital to £500,000 by the creation of 100,000 new shares of £1 each was unanimously agreed to.

United River Plate Telephone Co., Ltd.

The gross revenue of the company for the year ended December, 1923, amounted to £1,533,564, whilst the gross maintenance and other charges in Argentina and London were £1,319,456, leaving a profit for the year of £214,108. To this is added exchange suspense account £35,000, making £249,108. After deducting interest on debenture stock and dividend on the preference shares for the year and the interim dividend on the ordinary shares, £144,608 remains, plus £33,056 brought forward, leaving an available balance of £177,665. It is proposed to pay a final dividend of 5 per cent. on the ordinary shares, making a total of 8 per cent. for the year, free of income tax at 4s. 7½d. in the £, and to carry forward £42,665. "The business of the company has made considerable progress, the number of new stations connected during the period covered by the accounts constituting a further record. In consequence, however, of causes beyond the company's control the requirements of the Government Decree of October, 1922, could not quite be complied with, but the authorities, recognising the difficulties, granted an extension of time which enabled the company to carry out the terms of the decree. Considerable extensions to the plant are being made in order to meet the continued demand for telephone service." For reasons of health Sir Frederick Green has resigned the chairmanship of the company, but he will remain on the board as deputy chairman. Mr. Percy Cross has been elected chairman. Meeting: London, June 10th.

Lancashire Electric Light and Power Co., Ltd.

The annual meeting of the company was held on May 29th, under the chairmanship of Mr. Alfred Shepherd. In moving the adoption of the report and accounts (*vide* ELECTRICAL REVIEW, May 23rd, p. 853), the chairman said that during the year the capital had been increased by the issue of further 7 per cent. participating preference shares and ordinary shares, making the total issued capital £1,702,500. The whole of the debenture stocks had been repaid out of the proceeds of this issue, leaving the company clear and free to borrow on the most advantageous terms. The reserve had been considerably increased—from £4,962 to £23,695, and it was proposed to transfer a further £10,000 to it. The depression in the textile trade had affected the business of the Parliamentary Co., but there were signs of improvement, and if these materialised the company should benefit in the latter part of the current year. The colliery trade had improved, and the power supplies to collieries had increased. The output generally had shown a satisfactory increase, and reductions had been made in the charges to all classes of consumers. It was anticipated that a new 10,000-kW set would be brought into service in August this year. The board had decided to replace the four original vertical sets by two 6,000-kW turbo-alternator sets, with additional boiler plant. When these additions were completed the company would be in possession of 60,000 kW of modern plant.

The company's system had been linked up with the new Barton station of the Manchester Corporation by 33,000-V mains, and a similar main had been laid to give an additional supply to the Rochdale Corporation. During the year a supply to Chorley was inaugurated, and bulk supply agreements were entered into with the Urban District Councils of Norwich and Newton-in-Makerfield.

The Electricity Commissioners had approved of the erection of an additional generating station in the Mid-Lancashire district, the industrial portion of which was in the company's area of supply.

Cawnpore Electric Supply Corporation, Ltd.

The annual meeting was held on May 28th, under the chairmanship of Mr. J. G. B. Stone. In moving the adoption of the report and accounts (*vide* our last issue, p. 892), the chairman said that the accounts showed a marked improvement, the surplus being £24,672 greater than that of 1922. During the year the output increased by 4,472,549 kWh to 11,808,925 kWh. The demand for energy in Cawnpore continued to expand, and necessitated further capital expenditure. Accordingly, since the close of the year, the ordinary share capital had been brought up to £160,000 by the issue of the balance of 1,493 shares. The balance of the 7 per cent. preference shares (78,507) had also been issued. By special resolution the dividends on the preference shares had been made accumulative. The applications for supply continued to increase, and the company was applying for permission to extend its area. The first of the two new 6,000-kW sets was expected to be in operation in July or August, and the other very shortly afterwards.

British Electric Traction Co., Ltd.

The gross profit of the company for the year ended March 31st, 1924, was £278,667 against £263,823 for 1922-1923. After deducting general expenses (£45,416) the net profit is £233,251. Debenture stock interest requires £80,891; dividend of 6 per cent. upon the cumulative participating preference stock absorbs £42,765; the dividend of 6 per cent. for the year upon the ordinary stock (on account of which 2 per cent. has already been paid) requires £79,576; and £30,019 is to be added to undivided profits account, making that account £245,381. The amount standing to the credit of reserve account is £520,000. The investments, which now stand in the balance sheet at £1,283,188, show an increase of £313,167. The yield from investments amounted to £240,931, representing an average of 5.62 per cent. for the year, compared with 5.49 per cent. for the preceding year. Meeting: June 16th.

Electric Construction Co., Ltd.

The directors report that the net profit for the year ended March 31st, 1924, after providing for debenture interest and £10,000 for depreciation, is £40,386 plus £20,725 brought forward. The interim dividend of 7 per cent. per annum on the preference shares absorbed £2,197, and that of 6 per cent. per annum on the ordinary shares, £9,000; both were paid less tax. It is now proposed to pay a final dividend at the rate of 7 per cent. per annum on the preference shares, a final dividend at the rate of 9 per cent. per annum on the ordinary shares (making a dividend of 7½ per cent. for the year), requiring £13,500; a bonus of 2½ per cent. on the ordinary shares, requiring £7,500; all dividends under deduction of income-tax; and to transfer to a superannuation fund for the benefit of the staff and workpeople, £5,000, leaving to be carried forward, £21,717. "During the past financial year an increased demand for the company's products was experienced, but the improvement was not sufficient to counteract further reductions in selling prices which were necessary to meet the severe competition, both at home and abroad." Meeting: London, June 12th.

French Electrical Companies.

The report of the *Compagnie Centrale d'Energie Electrique*, of Paris, for last year shows a net profit of 2,632,131 fr., as compared with only 2,208,442 fr. in 1922.

La Société de l'Energie Electrique de Rouergue, which was formed last year, has recently increased its capital from 20 to 30 million fr. Large stations are to be established in the Departments of Herault and Aveyron, the whole output of which has been already contracted for.

The *Compagnie Francaise Thomson-Houston* is maintaining the rate of dividend for 1923, at 45 fr. per share.

The *Compagnie des Appareils Electriques et Compteurs Garnier*, of Lyons, reports net profits amounting to 330,000 fr. for 1923, and a dividend at the rate of 50 fr. per share on the old capital and 15.60 fr. on the new.

The *Société Gramme* reports that the volume of transactions in 1923 was considerably greater than in the previous year, although the gross profits at 2,447,000 fr. were less by 220,000 fr. than in 1922. The net profits amounted to 552,000 fr., permitting of the payment of a dividend at the rate of 60 fr. per share.

The directors of the *Société Le Materiel Isolant*, of Lyons, report net profits of 214,000 fr. for 1923 and a dividend at the rate of 34 fr. per share.

The *Société Continentale Edison*, after having made provision for depreciation, record net profits of 1,101,000 fr. for 1923, this result comparing with 775,000 fr. in the previous year. It is intended to distribute a rate of 30 fr. per share as against 25 fr. in 1922.

The *Société des Ateliers de Constructions Electriques de Delle*, of Paris, after having made provision for depreciation, reports net profits of 1,046,000 fr. for 1923, or slightly more than in the preceding year. The dividend is at the rate of 60 fr. per fully paid share.

The *Société des Forges et Ateliers de Constructions Electriques de Jeumont*, which has a share capital of 80,000,000 fr., reports net profits amounting to 11,099,000 fr. for 1923, as compared with 11,035,000 fr. in the previous year. It is proposed to pay a dividend at the rate of 25 fr. per share (10 per cent.) as in 1922.

The report of the *Compagnie Radio-France*, of Paris, states that the company's installations were completed in 1923. The working of the first transoceanic connection established with the United States in August, 1922, was very satisfactory, and the increase in the traffic in the final months of 1923 was about 200 per cent. as compared with the early months of the same year. A Press service with the Argentine Republic was started in 1923 and was amplified so as to comprise communications in both directions in January, 1924, while this year a regular service will be definitely assured for all classes of messages. A large station was being erected near Rio de Janeiro in view of connections between Brazil and Europe, and the company had obtained a contract for traffic with this station, which was to be completed at the beginning of 1925. The traffic with Beyrouth, which was opened in December, 1922, had largely increased. Concerning the central installation at Sainte-Assise, the report states that trials were now proceeding in the sense of a connection with China and Japan, and the results were such as to permit of the hope that regular and rapid communications would take place as soon as these two countries themselves possessed stations of a power and efficiency comparable with those of the Radio-France. The net profits of 679,000 fr. for 1923 have been carried forward.

Austrian Electrical Company.

Felten und Guilleaume, Fabrik Elektrischer Kabel, Stahl und Kupferwerke A. G. Wien.—The report presented to the meeting for the year 1923 showed a net profit of eight milliard kronen, from which was distributed 5.062 milliards, or 15,000 kr. per share, one milliard kronen was placed to reconstruction reserve, and 400 million kronen to the workmen's fund, 182.4 million being carried over. In the first half of 1923 the occupation of the Ruhr had occasioned the receipt by the firm's Steier works of numerous important orders, notwithstanding which sales left much to be desired. In the second half of the year business took on a different aspect, and big cable orders from home and abroad came in. Up to the present the works were also well supplied with orders. Exports to the new States (Czecho-Slovakia, &c.), owing to the prohibitive duties, had almost ceased; while the home market, due to insufficient tariff protection, was exposed to outside competition. Developments in the future were, therefore, very uncertain.

German Companies.

The Insulated Wires Company (late Vogel), of Berlin, states that the degree of activity in 1923 was satisfactory; the net profits in paper marks have been carried forward to 1924.

The North German Cable Company, of Berlin, states that the turnover in 1922-23 slightly declined in consequence of a strike. The net profits, 1.8 billions of paper marks, have been carried forward.

The "Siemens" Electrical Works Company, of Hamburg, states that the participations in two foreign supply works had to be disposed of in 1923 in order to be able to maintain and extend the works in Germany. The operation of the latter has resulted in a loss in the past two years.

The report of the Mix and Genest Company of Berlin-Schoneberg, states that the works were fully occupied during the greatest part of 1923, and the turnover in gold currency took an upward course. At present the stock of orders is wholly satisfactory and will afford remunerative activity for a long time forward. The course of business in the case of the company's branches and subsidiaries is satisfactory in general and in part is very good. As mentioned in a previous issue, the net profits have been carried forward.

Manila Electric Corporation.—According to the *Financial News* the report for 1923 states that the gross revenues for the year were $3,571,861, a decrease of $12,260; operating expenses and taxes amounted to $1,820,508, a decrease of $118,848; operating income was $1,751,352, an increase of $108,587. Four quarterly dividends, amounting to $559,970, were declared and paid, leaving $500,769, which was transferred to surplus. Depression in business conditions in Manila during 1923 caused a decrease in railway gross revenue of $76,181. Despite this depression the electricity department revenues continued to improve, showing an increase of $72,243.

Reduction of Capital.—PARAGON ELECTRIC WELDING CO., LTD., AND REDUCED.—A petition for the confirmation of the reduction of the capital of the above company (formerly known as the Paragon Electrical Engineering and Installation Co., Ltd.) from £10,000 to £5,255, has been presented to the High Court and will be heard in London on June 17th.

Brisbane Electric Tramways Investment Trust, Ltd.—Yesterday shareholders were to meet to approve the agreement between the Brisbane Tramway Trust and the Brisbane Tramways Co., determining the purchase money for the tramway undertaking at £1,400,000, payable in cash with interest at 5¼ per cent. from January, 1923, to date of payment.

Stock Exchange Notices.—Applications were recently made to allow the following to be quoted in the Official List:—

English Electric Co.—142,514 ordinary shares of £1 each, fully paid, Nos. 1,521,510 to 1,664,023.

Metropolitan Railway Co.—£1,000,000 3½ per cent. "A" debenture stock.

Doulton & Co., Ltd.—Including the balance brought forward there is a credit balance of £78,035 after meeting debenture and preference interest for 1923. A dividend of 6 per cent. on the ordinary shares is recommended, carrying forward £54,035.

Globe Telegraph & Trust Co., Ltd.—Final dividends of 3s. per share, less tax, on the preference shares and of 5s. per share net on the ordinary, making 6 per cent., less tax, and 10 per cent. net respectively.

West Coast of America Telegraph Co., Ltd.—The accounts for 1923 show a net profit of £11,188. After paying 6 per cent. on the non-cumulative preference shares, £5,000 is put to reserve and £7,767 carried forward.

Burmah Electric Tramways and Lighting Co., Ltd.—According to the *Financial News*, an interim dividend of 2½ per cent. less tax (the first dividend declared) on the ordinary shares is recommended.

Metallic Seamless Tube Co., Ltd.—After paying a dividend of 5 per cent. on the ordinary shares, £992 is to be carried forward.

Canadian General Electric Co., Ltd.—Quarterly dividend of 1¾ per cent. (at the rate of 7 per cent. per annum) on the preference stock.

Western Telegraph Co., Ltd.—Third quarterly interim dividend of 5s. per share, free of income tax, being at the rate of ten per cent. per annum.

Radio Corporation of America.—Dividend of 3½ per cent. for the first half of 1924 on outstanding preferred stock.

Anderston Foundry Co., Ltd.—Final dividend of 9s. per share, less tax, making 12s. per share. Carried forward £5,477.

Stocks and Shares.

MONDAY EVENING.

EVERY week brings fresh news regarding the negotiations which are taking place in connection with the Electricity Bills. Powerful interests oppose in most cases the companies' intentions, but steady progress is being made with the matter in hand, and meanwhile the air is thick with rumours of what is going to happen, estimates of what is likely to occur and expectations of how the dividends will be affected by the final result when this is reached. There is far more interest in the case than dealing in the shares, the prices of which remain very steady, but show scarcely any alterations on the week. In fact, the market has been moving on an even keel for a month or more, owing to the uncertainty of the position. The Stock Exchange idea is that, roughly speaking, the dividends that are at present being paid on ordinary shares will be maintained in one way or another. If new shares are distributed from reserve accounts, the dividends on the existing shares are

likely to come down, the loss to be compensated, however, by distributions on the reserves so capitalised and divided amongst stockholders.

The event is expected to show the proprietors to be left in much the same position as they stand now, plus, of course, the knowledge that their security will derive a more enduring character through the fact of the companies' tenure of life being materially lengthened. Whatever may happen, the profits for 1924, the present year, will not be affected by legislation, and it is known that the industry as a whole is continuing to prosper as vigorously as it did in the bumper years 1922 and 1923. No. 1 Bill (East End group) was passed last Friday by the House of Lords Committee appointed to deal with it, and No. 2 Bill of the County company proved equally successful a few days previously. The amalgamation of the East End group, *i.e.*, that in which the County of London company stands foremost, and also the amalgamation of the other group, are now brought a step nearer consummation. From the point of view of the consumer, a sliding scale of rates for supply is to be imposed, but those who are best qualified to speak in regard to this subject consider that this is likely to be settled on terms not unfavourable to the companies.

Westminster ordinary are 5s. down on the week at 10¼. London Electrics eased off to 30s. 6d. These are the only changes in the London list. Whitehall Electric preference are better at 21s. 6d., and the company's debenture stock has strengthened to 95½. Tokyo Electric Sixes are a harder market at 90¼. This price carries the half-yearly interest payment due a fortnight hence.

The cable *v.* wireless controversy continues to rage. Protagonists and antagonists of both systems of communication are laying about them furiously, and prices of cable stocks in the market reflect the uneasiness that has not yet vanished from the minds of cable stock proprietors rendered apprehensive by the latest developments in the wireless world. The stocks peculiarly affected are those of the Eastern group, where prices have weakened. It may seem a little curious that Marconi shares are also hanging fire, but this is due to the decision of the directors not to pay an interim dividend for 1923. It may be recalled that the previous twelve months' dividend was 15 per cent., and those who anticipate that this rate will be repeated for last year are deemed to be somewhat optimistic.

Eastern ordinary is down 3 points. Eastern Extensions have fallen 7s. 6d., Globes and Westerns both 5s. each. Anglo-American preferred is ½ down, though this has nothing to do with the cable controversy, but is connected with the slight heaviness which has overspread fixed-interest stocks by reason of the fear that there may be a rise in the bank rate. Such a move on the part of the Bank of England might be forced through the fresh demoralisation that has fallen upon rates of exchange, and which has led to a little dulness in the purely investment groups all round. Dollar stocks have risen: Rio Tramways Firsts are up to 100.

Telegraph manufacturing shares are a decidedly good market. Henleys, British Insulated, Callenders are all better, the Callender report serving to infuse further strength into this market on top of the improvements that occurred last week. Moreover, a good deal of buying is taking place. Siemens are not neglected in this demand, although the passing of the dividend which caused the recent reaction in the price leads to caution being shown in purchase of the shares, and the price is unchanged at 18s. 3d. General Electrics moved upwards, and there is a good deal of speculation as to what the dividend is likely to turn out. Some people profess that they would be satisfied with a repetition of the previously-paid 5 per cent.

Home Railway stocks are heavy, on the talk that there is of a possible strike this week on the tubes. The Underground issues are lower. Districts fell 1 to 52 and Metropolitans ½ to 80¼. Underground Incomes can be bought at the middle price of 95. British Electric Tractions eased off to 85, despite the satisfactory nature of the report. Isle of Thanet Tramways preference keep good at 5½ on the scheme for dealing with the arrears of dividend. It is proposed to split the present ordinary and preference £5 shares into others of £1 each, and to change the name of the company to the Isle of Thanet Electric Supply Company, Limited.

Babcock & Wilcox rose to 47s. Metropolitan Vickers ordinary at 1 1/32 are the fraction to the good. Speculative investment may observe that India Rubber shares, quoted about 13s. 9d., have had no part in the strength lately a feature amongst similar issues. Venezuela Telephones came up sharply to 14s. 6d.: there is an idea that the next dividend will be an improvement upon the 5 per cent. last paid. The rubber share market exhibits no increase in vitality, the price of the produce remaining at about 10¼d. per lb.

Share List of Electrical Companies.

Home Electricity Companies.

	Nom. £	Dividend. 1922.	Dividend. 1923.	Price June 2, 1924.	Rise or fall.	Yield. p.c.
Brompton Ordinary	1	12	10	37/-	—	*£5 8 1
Charing Cross Ordinary	1	14	14½	41/6	—	6 19 9
do. do. do. 4½ Pref.	1	4½	4½	17/-	—	5 6 0
Chelsea	1	10	12	36/3	—	6 12 7
City of London	1	15	15	45/9	—	6 11 0
do. do. 6 % Pref.	1	6	6	23/6	—	5 2 2
County of London	1	10	15	47/-	—	6 7 8
do. do. 6 % Pref. ...	1	6	6	1½	—	5 6 0
Edmundson's Ordinary	3	7	7	5	—	4 4 1
do. 6 % Pref.	5	6	6	5½	—	5 17 1
Kensington Ordinary	5	12	14	10	—	7 0 0
London Electric	1	10	10	30/6	−6d.	6 11 2
do. do. 6 % Pref. ...	5	6	6	5½	—	5 11 7
Metropolitan	1	8½	10	1½	—	5 14 3
do. 4½ % Pref.	1	4½	4½	17/-	—	5 6 0
Newcastle-on-Tyne Ordinary ...	1	2½	6	18/9	—	6 8 1
do. 5 % Pref. ...	1	5	5	17/-	—	5 17 8
do. 7 % Pref. ...	1	7	7	24/-	—	5 16 8
Notting Hill 6 % Pref.	10	6	6	9½	—	6 6 4
North Met. Elec. 6 % Pref. ...	1	6	6	21/3	—	5 13 0
Urban Ordinary	1	—	4	18/9	—	4 5 8
do 6 % Pref. ...	1	5	6	1	—	6 0 0
St. James' and Pall Mall ...	5	14½	*17½	13½	—	6 13 4
South London	1	11	15	42/-	—	6 7 2
South Metropolitan Pref. ...	1	7	7	1½	—	5 13 0
Westminster Ordinary	5	12	15	10½	— ½	7 6 4
Whitehall Elec. Invst. 7½ % Pref.	1	7½	7½	21/6	+6d.	6 19 6

Home Rails.

Central London Ord. Assented	Stock	4	4	68½	—	5 16 10
Metropolitan	,,	5½	4	80½	— ½	4 19 5
do. District	,,	3	3½	53	—1	6 14 7
Underground Electric Ordinary	10	Nil	Nil	2½	— ½	Nil
do. do. "A" ...	1	Nil	Nil	7/6	−6d.	Nil
do. do. Income	Bonds	5	5	95	—	*6 6 4

Telegraphs and Telephones.

		Dividend. 1921	Dividend. 1922			
Anglo-Am. Tel. Pref.	Stock	6	6	109½	— ½	5 16 0
do. Def.	,,	1½	34/6	23⅜	—	6 6 4
Chile Telephone	5	6	6	6	—	5 0 0
Cuba Sub. Ord.	10	7	7	7	—	10 0 0
Eastern Extension...	10	10	10	16¾	— ⅜	6 0 4
Eastern Tel. Ord.	Stock	10	10	167½	−3	5 12 4
Globe Tel. and T. Ord.	10	10	10	17½	— ½	5 14 3
do. do. Pref.	10	6	6	11½	—	5 7 10
Great Northern Tel.	10	24	22	28½	— ¾	7 14 4
Indo-European	25	10	7	33½	—	*5 6 1
Marconi	1	25	15	1½	— 1/8	10 0 0
Oriental Telephone Ord.... ...	1	12	12	1⅛	+ 1/8	*6 8 9
United R. Plate Tel.	5	8	8	7	—	*5 14 6
West India & Panama	10	Nil	Nil	1/-	—	Nil
Western Telegraph	10	10	10	16½	— ¼	6 1 3

Home and Foreign Trams, &c.

Anglo-Arg. Trams First Pref....	5	5½	12½	8¼	—	8 9 0
do. do. 2nd Pref. ...	5	Nil	5½	2⅛	—	10 4 4
do. do. 5% Deb. ...	Stock	5	5	71½	—	6 19 10
British Electric Traction Ord....	,,	4½	5	85	−1	7 1 2
do. do. 6% Pref. ...	,,	6	6	101½	+ ½	5 18 3
Brazil Traction	100	Nil	4	57	+ ½	7 0 0
Brit. Columbia Elec. Rly. Pcs.	Stock	5	5	66½	—	5 15 7
do. do. Preferred	,,	5	96/-	87½	+1	*5 10 9
do. do. Deferred	,,	8	127/-	104	—	*6 3 9
do. do. Deb.	,,	4½	4½	80½	—	5 5 7
Lond. & Sub. Trac. 5 % Pref. ...	1	8½	5	7/6	—	6 13 4
London United Tram. Deb. ...	Stock	4	4	47	—	8 10 2
Mexico Trams. 5% Bonds ...	—	Nil	Nil	73½	—	6 16 0
do 6% Bonds ...	—	Nil	Nil	50½	—	Nil
Mexican Light Common ...	100	Nil	Nil	29½	—	Nil
do. Pref.	100	Nil	Nil	47½	—	Nil
do. 1st Bonds ...	—	Nil	5	68½	—	7 6 0

Manufacturing Companies.

Babcock & Wilcox...	1	15	20	47/-	+9d.	*5 2 2
British Aluminium Ord.... ...	1	10	5	24/6	—	4 1 8
British Insulated Ord.	1	15	15	2⅜	+ 1/8	5 14 3
Callenders	1	15	15	52/6	—	5 14 3
do. 6½ Pref....	1	6½	6½	23/9	—	5 9 5
Crompton Ord.	1	10	5	⅞	—	5 17 10
Edison-Swan	4/-	Nil	7½	5/-	—	6 0 0
do. ,, 5% Deb.	Stock	5	5	78½	—	6 7 5
Electric Construction	1	10	10	1⅛	—	6 7 5
English Electric	1	8	5	16/9	+6d.	5 19 5
do. do. Pref.	1	6	6	19/6	+6d.	6 3 1
Gen. Elec. Pref.	1	6½	6½	23/6	+6d.	5 10 8
do. Ord.	1	10	5	20/3	+ 6d.	4 18 9
Henley	1	15	15	2⅜	+ 1/8	5 14 3
do. 4½ Pref.	5	4½	4½	4½	—	5 9 1
India-Rubber	1	10	10	½	—	*7 5 6
Met.-Vickers Pref....	2	8	8	2⅞	—	6 11 2
Siemens Ord.	1	10	10	18/3	—	Nil
Telegraph Con.	12	20	20	24	—	*6 0 0

* Dividends paid free of Income Tax.

Some of the Exhibits at Wembley.

Messrs. E. Green & Son, Ltd.

(*Stand No.* 78, *Avenues* 4 *&* 5, *Bays* 15 *&* 16.)

This company shows a number of full-sized economisers as well as models and accessories. One important exhibit is a tri-tube horizontal economiser complete with connecting bends. This type is designed for erection over water-tube boilers where head-room is limited. Each section, consisting of three tubes only (see fig. 83), is supported at the back and front on vertical supports provided with projections on which the headers lie flat, their ends being recessed on the underside for this purpose. The sections of tubes may be any number in

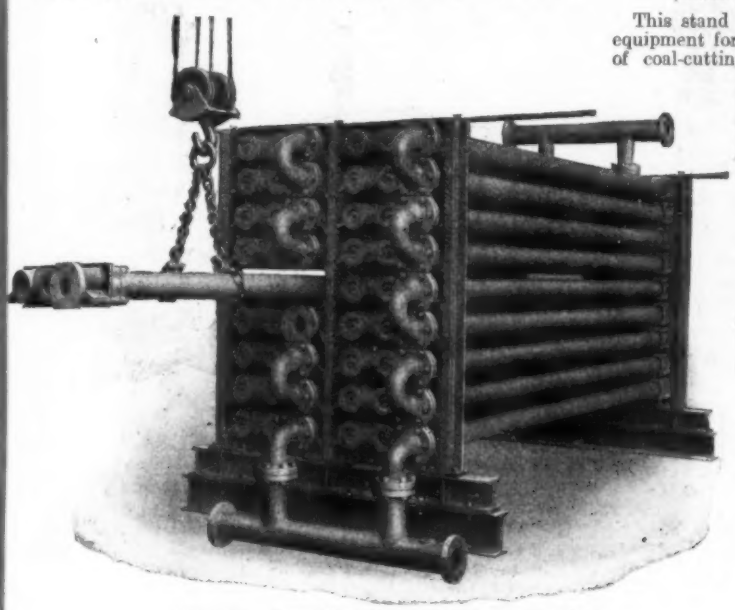

Fig. 83.—Green Tri-tube Horizontal Economiser.

height or width to suit the dimensions of the boiler casing. The water can be made to pass along the bottom row, returning along the next row and passing through each successive layer of tubes in series, or, on the other hand, it can be made to enter the lowest two or three rows simultaneously, returning along the next two or three rows in parallel, and back along the remaining rows, thus putting the economiser partly in series and partly in parallel as may be desired. The economiser can be arranged with either vertical or horizontal baffles, so arranged that the gases will travel in three passes through the economiser chamber. As the plant is erected at

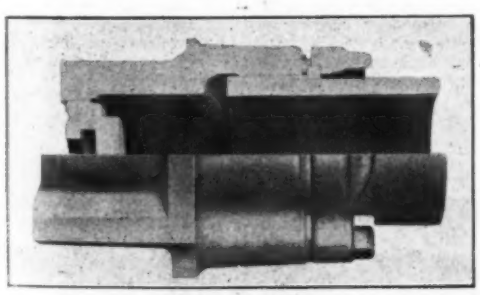

Fig. 84.—Detail of Ringstay Joint.

a great height, the design is such as to ensure accessibility for examination and repairs. The individual sections are of light weight and easily removed, as shown in fig. 83. An important detail in this and other economisers of the firm's manufacture is the method of jointing the tubes and headers. The joint, which is illustrated in fig. 84, consists of an external ring-plate and a split ring which are passed over the tube end and held in contact with the shoulder of the tube by the ring-plate, which is secured by four set screws. Direct pull tests have demonstrated that each of these joints is capable of sustaining a load of 20 tons irrespective of friction.

A full-sized ringstay economiser of 48 tubes is also shown. This is specially constructed for exteremely high pressures. Circular headers, which lend a greater resistance to extreme internal pressure, take the place of the flat-topped rectangular design. Another exhibit is a rectangular tube air heater of 30 elements. Each element occupies a space of just under 1 cu. ft., and consists of four rectangular tubes cast in one piece with two end flanges. The elements may be built up side by side, end to end, or one above the other as desired. A full-sized standard economiser with 98 tubes is also exhibited, complete wth scrapers, gearing, valves, &c. For the rest the exhibit consists of a model showing the application of an economiser to a water-tube boiler, valves, dampers, doors, and other accessories.

Messrs. Mavor & Coulson, Ltd.

(*Stand No.* 54, *Avenues* 5 *and* 6, *Bays* 20 *and* 21.)

This stand bears a very comprehensive display of electrical equipment for mines. Prominent among these are a number of coal-cutting machines of various patterns. A medium-sized bar-type cutter fitted with an overcutting gearhead, for employment in a position higher than 18 in. from the floor, is exhibited. The motor is wound for a d.c. supply, and the cutter bar is 4 ft. 6 in. long. In the undercutting type, which is also shown, the bar is practically at floor level. A "midget" size bar cutter only 13½ in. high, with a 3 ft. 6 in. bar, is also shown. Other coal-cutting machines to be seen are a "Samson" disk-type cutter; two

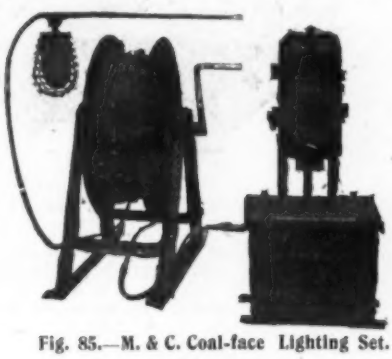

Fig. 85.—M. & C. Coal-face Lighting Set.

chain-type machines; and a universal bar machine in skeleton form demonstrating the way in which the gearing is employed in the company's bar cutters. A coal-face electric lighting set is shown. The transformer of this set is connected between two phases of a 3-phase system, the secondary being wound for 25 V. From the transformer a concentric

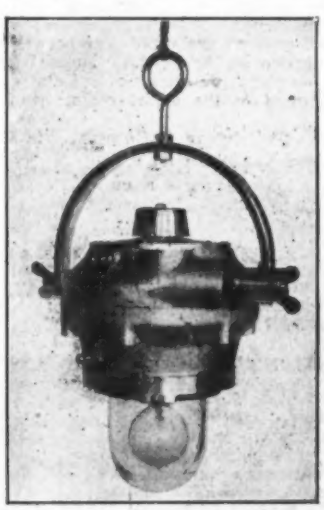

Fig. 86.—Compressed-Air Electric Lamp.

c.t.s. cable is taken, and at 10-ft. intervals concentric junctions, tapped with ⅜-in. thread, are connected for attachment of the lamp fitting. When not in use the cable can be coiled on a drum, as shown in fig. 85. Another (self-contained) lighting set is exhibited. This consists of a compressed-air turbine driving a small electric generator, which supplies energy to a metallic-filament lamp. The compact nature of the equipment can be judged from the illustration, fig. 86.

Conveyors of two kinds are shown. One of these is a band-type conveyor. The driving gear is equipped

with a three-phase motor, and the gearing and motor can be quickly transferred to either side of the delivery structure to suit the position of the conveyor at the coal face. The driving gear of a shaker conveyor, similar to that installed in the Model Coal Mine, is also on view. A "jigging" action is transmitted to the conveyor pans through

Fig. 87.—M. & C. Motor-Control Pillar for Non-fiery Mine.

a wire rope drive or a rigid connecting rod. The length of the stroke can be varied according to the inclination of the conveyor. Another exhibit is a portable electrically-driven hauler. This is provided with an 8-10 h.p. motor, the whole of the driving gear being enclosed in a dust- and flame-proof casing.

A great deal of mining switchgear is included in the display. Fig. 87 shows a control pillar for haulage service in a non-fiery mine. Everything pertaining to the control of the motor is contained within the sheet-steel housing. Several types of starting pillars are shown both for a.c. and d.c. machines. Ironclad switchboards of the built-up "unit" type are also exhibited. Another exhibit is illustrated in fig. 88; this is an oil-immersed controller of the horizontal lever-operated pattern, in conjunction with an air-cooled flame-proof resistance, the two pieces of apparatus being interconnected to form one unit. The equipment is designed for haulage service in fiery mines. In addition to the large collection on its stand, the company has also supplied a great deal of equipment to the model colliery and the subjoined exhibition.

Switchgear & Cowans, Ltd.

(Stand No. 8, Avenue 9, Bays 23 and 24.)

To illustrate the company's range of ironclad oil-immersed switchgear the following exhibits are shown:—

A three-panel draw-out type board for pressures up to 3,300 V, and line currents up to 60 A is shown, consisting of three ironclad units with an incoming cable box to the bus-bars, and with an end cap at the other end to permit of ready extension of the board for additional circuits. Each switch is provided with three series-wound overload coils and transformer-operated ammeter. All actuating coils, trip mechanism and meter transformers are contained within the oil tank, protected thus from derangement by dirt, mechanical damage, or interference. Alternative arrangements are shown by which the circuit cables may be taken either upwards, downwards or horizontally from the pillars.

One of the panels is fitted with a core balance transformer

Fig. 88.—Oil-immersed Controller for Fiery Mine.

and relay, designed to trip the switch when on three-phase load the leakage current to earth exceeds 5 per cent. of the normal. The method of carrying a watt-hour meter on a swinging panel is also shown. A single pillar unit is shown fitted with overload trips and ammeter, and, in addition, a no-volt trip with arrangements for electrically interlocking the starter for motor control. A further example is shown of a single pillar unit on a dwarf pedestal stand and of flame-proof construction throughout.

Interlocking arrangements are provided on all draw-out switches.

Examples are shown of the non-drawout type for wall mounting and floor mounting on c.i. pedestals, both flame-proof and non-flameproof, and also showing the great adaptability of the design for cables incoming or outgoing in any direction.

An example is shown of a three-phase oil-immersed gate-end switch (fig. 90), fitted with time limit overload protection, and also a patented system for ensuring adequate earth continuity up to the coal cutter and complete safety from shock to operators or danger of open sparking. By this system the gate switch will trip and cut all pressure off the motor and trailing cable in the event of the earthing becoming inefficient, the trailing cable becoming damaged, or any attempt to withdraw pommels from either coal cutter or gate switch. A further example is shown of a gate switch with pommels

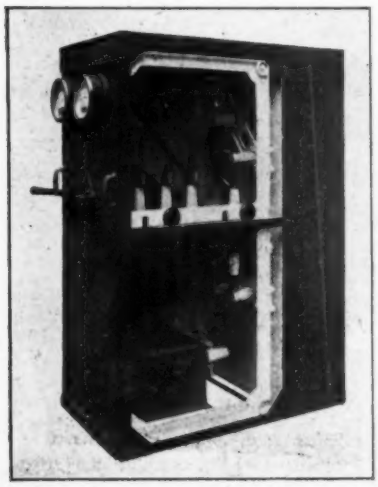

Fig. 89.—S. & C. 6,600-V, Three-phase, Truck-type Cubicle.

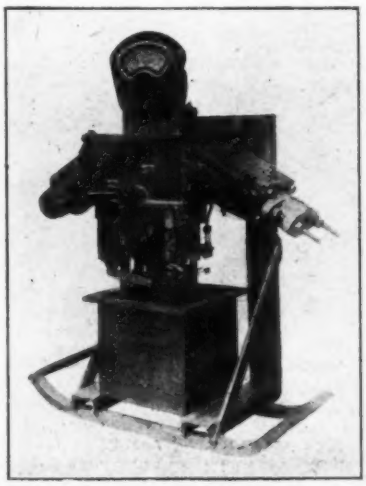

Fig. 90.—A Three-phase Oil-immersed Gate-end Switch.

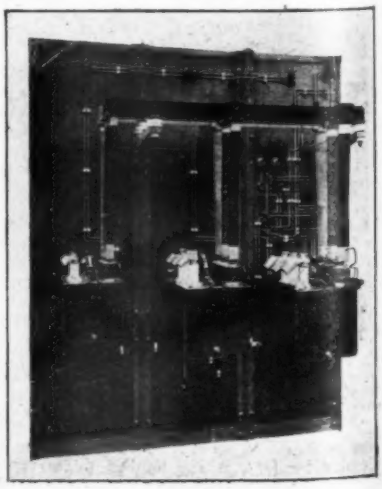

Fig. 91.—A Three-panel L. P. Three-phase Switchboard (Back).

of similar construction, but arranged with a mechanical interlock only to trip the switch as soon as any attempt is made to withdraw the pommel. These gate switches are fitted with skids on the tanks or stands to facilitate removal in the pit.

Ironclad air break switchgear of unit construction is made by the company for pressures up to 600 V for either d.c. or a.c., and examples are shown in sizes up to 400 A capacity. All live parts are carried on mild steel bars covered with a special insulating material on the "metal mica" principle. The units comprise switches, fuses, bus-bar chambers, and pedestals, and can be assembled to form boards of any number of ways. The fuse handles are composed of a heat-resisting, non-hygroscopic moulded material of excellent insulating properties and very tough nature. By a special construction the fuse contracts, which are self-aligning, are very readily removed for replacement. The fuse wire is carried in a patented removable baffle chamber, where the arc is split up and discharged through a number of vents so disposed as to cool and damp out the flame and effectively prevent arcing to the case. The construction of these boards enables them to be adapted for wall or floor mounting.

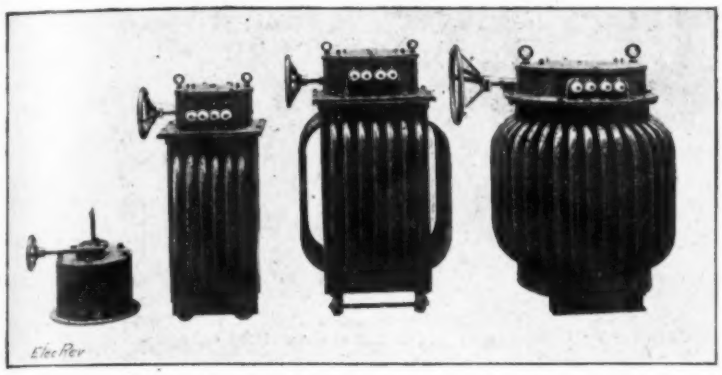

Fig. 92.—Switchgear & Cowans Induction Regulators and Boosters.

A truck-type cubicle is shown for pressures up to 6,600 V, three-phase, fitted with isolating plugs of the self-aligning type, oil switch, transformers and instruments (fig. 89). Interlocks are provided to prevent the truck being inserted or withdrawn while the oil switch is on, as well as an automatic shutter to screen the live parts when the truck is withdrawn. The truck runs on ball-bearing rollers.

A three-panel enamelled slate switchboard for low-pressure three-phase current is shown (fig. 91) fitted with oil circuit breakers, transformers, and the usual instruments, together with "Andrews" reverse power relays for the protection of alternators running in parallel. A number of automatic oil-immersed circuit breakers are exhibited.

Four sizes of induction regulating or boosting transformers are exhibited, up to 5, 10, 26, and 50 kVA capacity (fig. 92). These are used for all purposes where a variable pressure, which can be applied by gradual rise, is required, such as for pressure testing of cables, compensating for voltage drop in a.c. feeders, &c. These afford a good means of obtaining a variable pressure from a constant supply, for all testing purposes where a gradually varying pressure is required or for increasing the capacity of feeders without impairing the regulation. These transformers are arranged for direct or remote hand control and also for motor operation controlled by hand-operated switches or by automatic gear responding to rise and fall in line pressure.

Examples of transformers are shown for tapping a single-phase lighting circuit off power mains. These are of the oil-immersed type, controlled on the primary side by a d.p. oil switch with oil fuses. The fuse holders are withdrawable by raising a hinged lid interlocked with the switch movement so that no live parts can be touched.

New Motor Speciality Co., Ltd.

(*Stand No.* 143, *Avenue* 15, *Bay* 10.)

This company exhibits the "Win-Sum" electric radiator. This not only provides warm air but circulates it. The device consists of a suitable electric heating element behind which is placed a gently-running fan. The two components are set up in various forms, the best being probably the cabinet. This has four separately-switched heating elements, and the fan motor is controlled by a sliding resistance. If desired, the heating element can be replaced by a small ice chamber so as to secure the circulation of cold air. It is also possible to fumigate a room in a similar manner.

Messrs. J. J. Armfield & Co., Ltd.

(*Stand No.* 201, *Avenue* 1, *Bays* 27 *and* 28.)

This company (of Ringwood, Hants.) specialises in water turbines for use with small water powers, and several of these are exhibited. The "River" patent turbine shown is a modification of the Francis type, which has a very large specific capacity, a high specific speed, and a high efficiency both at full and part loads. It is designed for low falls and large volumes of water, and can be used on a fall of only 1 ft. As such turbines often have to work in places where skilled labour is not available, the construction is as robust and the design as simple as possible. Where Francis-type moving guide vanes are fitted, to give the highest efficiency at part load, all joints and working parts are of bronze or stainless steel, so that rusting and consequent wear are eliminated. The connecting levers are so designed that each guide vane can be separately adjusted to take up wear. A typical "River" turbine coupled to a dynamo on the same bedplate is exhibited. The set is depicted in fig. 93.

Another type of turbine shown is the aptly-named "British Empire" pattern. The rotor of this machine is of the mixed flow type and of cast iron throughout; it is designed with open water passages, so that it is not easily clogged by floating rubbish. The water is guided to the wheel by a volute guide case, no other guide vanes being necessary. The double turbine is very flexible, which makes it suitable for tide-hindered installations. The machine is built for either vertical or horizontal operation.

An oil-pressure compensated governor for employment with water turbines is another exhibit. This, it is claimed, enables the variation of the permanent speed to be reduced to ¼ per cent. of normal, and the momentary variation to within 5 per cent. between no-load and full-load.

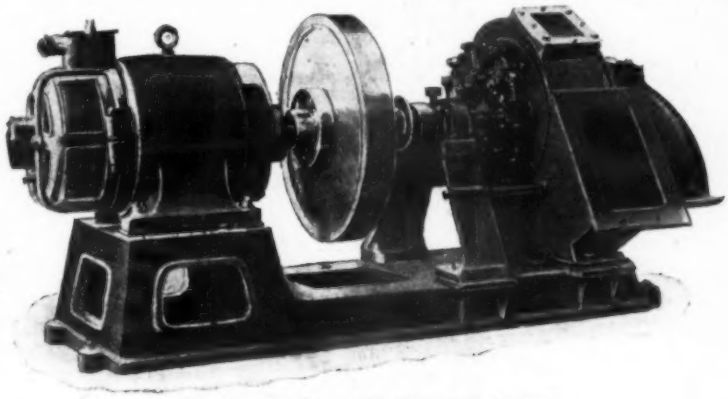

Fig. 93.—A "River" Turbine and Dynamo.

The remainder of the exhibit comprises rotors of the company's various turbines.

Messrs. Davidson & Co., Ltd.

(*Stand No.* 142, *Avenues* 2 *and* 3, *Bays* 17 *and* 18.)

Upon this stand the well-known "Sirocco" centrifugal fan is represented by an extensive variety of sizes and types. A 30-in. diameter induced draught fan, direct-coupled to an enclosed type forced lubrication engine is shown, and two of these fans are in operation at the power house. Of high-pressure fans, capable of maintaining pressures up to 30-in. water gauge, several examples are shown, one of which is utilised to keep a large ball in the air.

A "Sirocco" air washer, capable of dealing with 8,000 ft. of air per minute is shown in operation. The washer is used in conjunction with "Sirocco" heating and ventilating plant, and ensures the purity of an air supply to a building. The air washer is also extensively employed for cooling generators and other electrical machines. The makers claim that notwithstanding the fact that the air current has to pass through a thick bank of very fine mist, the purified air discharged by the machine carries absolutely no free moisture with it.

The firm is also showing a steam turbine heating unit which has recently been placed on the market. In this unit, the steam that supplies the heat also drives the fan, so that the fan power is thus obtained *gratis*.

The firm is showing in actual operation two model dust collectors. The Davidson patent dust collectors have only recently been put on the market, and are the outcome of many experiments and tests. They are capable of handling practically every kind of dust, coarse or fine, heavy or light, and are said to have a high efficiency. Further, they set up a low resistance to the flow of the air, and are conse-

quently economical in power consumption, and they occupy comparatively small space. The collector consists of a volute casing, which is provided with an inlet to allow the dust-laden air to enter tangentially. Beneath the volute is a series of alternating truncated cones and cylinders terminating in a dust receiver into which the dust falls. At the bottom of the receiver is an opening controlled by a sliding valve to allow the dust to be run into a sack or other suitable receptacle. An opening is arranged in the upper side of the volute, to allow the air which has been rendered free from dust to escape. The dust-laden air, on entering the volute, is subjected to centrifugal action by being forced to flow in a curved path, due to the curvature of the casing. The dust, owing to its greater specific gravity tends to move radially outwards and also to fall, so that on coming into the body of the collector, it approaches the dust outlet, following a helical path until it passes into the receiver. At the same time the air passes upwards through the opening in the top of the volute.

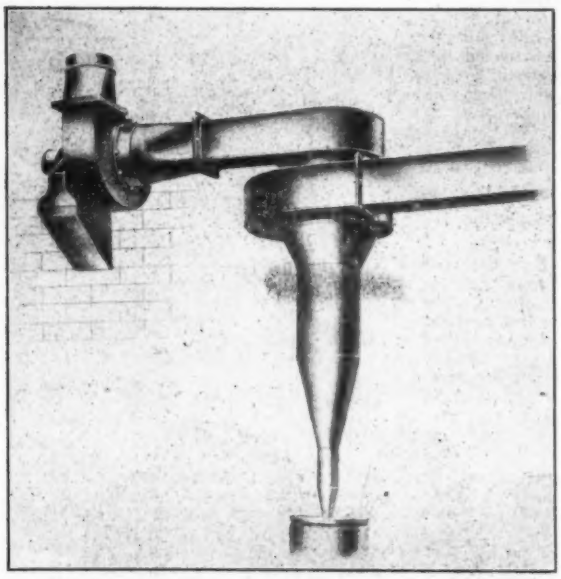

Fig. 94.—Davidson Suction Type Dust Collector.

A model is shown in operation on the stand of the suction type of dust collector (fig. 94), wherein the suction inlet of the fan is connected to the air outlet of the collector. The dust, consequently, does not pass through the fan. A pressure type of dust collector is also furnished by the firm; in this case the system of ductwork is connected to the suction side of the fan, and the collector to the discharge outlet.

A model of the Davidson patent flue-dust collector is shown for the first time. This is of the "shunt pressure type," in which a volute casing or primary separator is built round the chimney and works in conjunction with a secondary or small collector similar to the one previously described. The operation of this collector is as follows:—The induced draught fan discharges the dust-laden gas into the primary separator, which, with the chimney, forms a passage of constantly decreasing area converging on the chimney, without, however, being joined to or coming into contact with it. At a convenient position, a tangential slot or lip is formed, facing the direction in which the dust and gases are flowing. Owing to centrifugal force the dust remains in comparatively close contact with the periphery of the primary separator, and is guided by the lip to an external pocket, being air-borne into the latter by a small proportion of the main flue gases. The outlet from the pocket communicates with the secondary collector, the function of which is to allow the dust to pass into the receiver in the same manner as in the other model. The small quantity of gas which reaches this collector passes into the chimney by way of a discharge pipe. The main volume of gas enters the chimney through an opening at the side, but the construction and design of the primary separator is such that the dust, together with a substantial volume of gas, may re-circulate, in order to obtain the greatest possible benefit from the separation due to centrifugal action.

The remainder of the exhibit comprises machinery for the treatment (drying, cutting, &c.) of tea.

Messrs. Falk, Stadelmann & Co., Ltd.

(*Stand No.* 106, *Avenue* 14, *Bays* 9 *to* 11.)

A large collection of miscellaneous electrical apparatus and fittings appears on this stand. One of the principal exhibits is an ornate radio receiving cabinet, incorporating a five-valve panel and a loud speaker, with compartments for the batteries, &c. The aerials of this set are in duplicate, there being one in each of the pair of doors which close in the panel and loud speaker. Several examples of lighting fittings are shown, including alabaster bowls, silk shades, brackets, table and floor standards, &c. Many types of dry batteries are shown and the rest of the exhibit comprises fires, bells, tumbler switches, switch-plates, &c.

Messrs. Evershed & Vignoles, Ltd.

(*Avenue* 13*a*.)

This firm has a showcase in which are displayed examples of its portable testing sets of the "Meg," "Megger," and "Bridge-Megger" types; a hand-driven radio generator for providing a high-pressure supply for c.w. transmission of speech or Morse; an engine speed indicator, a helm indicator with a port and starboard dial, giving 35 deg. in each direction, with a "disappearing" pointer to show the absence of current; and a boiler room telegraph.

Messrs. Crossley Bros., Ltd.

(*Stand No.* 85, *Avenue* 13, *Bays* 9 *and* 10.)

Four of the company's engines are shown in operation upon its stand. One of these is illustrated in fig. 95, and is an 80-b.h.p. horizontal crude-oil, cold-starting engine designed especially for the driving of an electric generator. The engine can be started up from cold by compressed air in about a minute, and it works on the four-stroke cycle principle. The fuel oil is injected into the combustion chamber by a mechanically-operated pump through a sprayer nozzle. This system of airless fuel injection eliminates all danger of pre-ignition and results in high economy. The engine is typical of a range varying in power from 19 to 260 b.h.p., single- and double-cylinder types. Another engine shown which is suitable for electrical purposes is a 38-b.h.p. "G.E.117" gas engine; this is coupled to a 22.5-kW Crompton dynamo. This is also started by means of compressed air, and is fitted with "Crossley" variable-admission governing gear giving an impulse on every working stroke, ensuring steady driving at all loads. Ignition is effected by a l.p. magneto. The stand is lighted by the agency of a 6-kW Crompton dynamo, driven by a 12-b.h.p. horizontal type engine operating on town's gas. This also has variable-admission governing gear, and is representative of a class ranging in power from 3 to 19 b.h.p., and running on all classes of gaseous or liquid fuels. The company shows for the first time a two-stroke vertical crude-oil engine giving 14 b.h.p. at 450 r.p.m. This has a separate air scavenge pump, which ensures a thorough scavenging during each exhaust stroke, and leaves the inside of the cylinder with a charge of clean air to mix with the fuel oil as this is sprayed inside the combustion chamber. The result is the obtaining of greater power, higher economy, and a clean-working engine. This type of engine is specially suitable for dynamo driving or for belt driving for industrial purposes. The engine is pump lubricated at all the main moving parts, these being entirely enclosed in a crank chamber and easily accessible through removable doors on the crank case. The remaining exhibit is a Crossley open-hearth suction gas plant capable of generating sufficient gas to develop 37 b.h.p. It is fitted with a stepped grate and outside vaporiser. By this plant is a gas and air incorporator, by means of which the mixture can be regulated to give a constant value for industrial heating purposes.

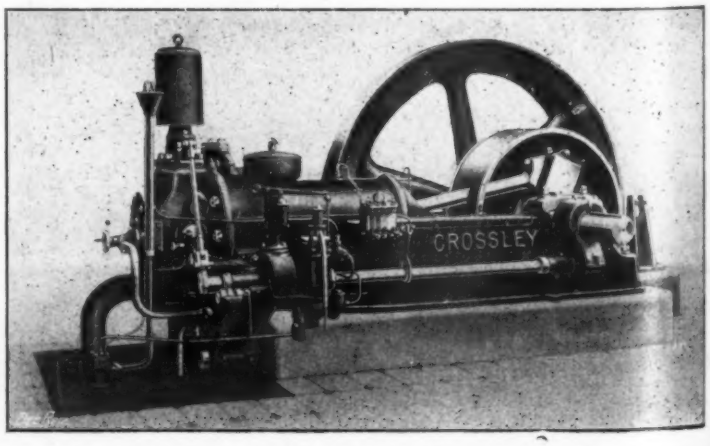

Fig. 95.—A Crossley 80-b.h.p. Crude-oil Engine.

The London Electricity Supply Problem.

Parliamentary Proceedings.

(*Continued from p. 901.*)

ON Thursday, May 22nd, the Chairman said he would give an indication of the direction in which the Committee's mind was working. The Committee hoped the scope of the Bill would be restricted to the areas of the ten companies; as the two Bills could not be amalgamated they should be made mutually exclusive; and the Committee doubted the desirability of retaining Sections 35 to 43 of the Bill relating to the technical committee.

Mr. CHARTERIS for the promoters said the Bill should be amended in the directions indicated, subject to the right to carry mains through intervening territory to link-up areas of the ten companies. The Electricity Commissioners had on the previous evening dealt with the outstanding matters on the agreement of the sliding scale, and nothing now remained except the companies' proposal to abolish the maximum price; for this purpose a clause had been inserted.

Mr. CRAIG HENDERSON, for the L.C.C., said he could not accept that, because the only condition upon which the L.C.C. would agree to this scheme was that points of difficulty were to be determined by the Electricity Commissioners, and the Commissioners objected to this clause which eliminated the maximum price.

The CHAIRMAN announced that the Committee would accept the Electricity Commissioners' views.

The fact that the points raised by the Chairman were to be met by the promoters removed all opposition on preamble, which the Committee then declared proved.

Electricity Supply (No. 1) Bill.

The Committee then proceeded to consider the Electricity Supply (No. 1) Bill.

Mr. ROWAND HARKER, for the promoters, said the Bill was promoted by the City of London Co., the County of London Co., the South London Co., and the South Metropolitan Co., and the general objects were the same as those of the No. 2 Bill, in order that the four companies in question might take their part in the reorganisation of the supply of electricity to London. The area of the four companies amounted to 430 square miles, partly inside and partly outside the County of London, and the companies supplied between 40 and 50 per cent. of the energy sold in the proposed electricity area for London and surrounding district. In 1923 the companies supplied 150 million kWh from the five stations which now existed, *viz.*, Bankside (60,000 kW); City Road (12,225 kW); Wandsworth (27,500 kW); Loughborough Junction (6,950 kW), and Blackwall Point (20,000 kW), a total installed capacity of 126,675 kW. In addition the County of London Co. was building a superstation at Barking, having a capacity, as a first instalment, of 90,000 kW, contracts having been entered into for £2,000,000. It was confidently anticipated that a supply would be given from Barking before the end of this year. Four of the stations had been linked up already, and eventually the scheme was to use Barking and Bankside as the main stations and to shut down, either partially or wholly, the others.

The general aim of the Bill, therefore, was the same as in the case of No. 2 Bill, it being considered that the companies could do much better service if they could deal with the business of the four companies as a whole. At the same time, there was the difference that the present promoters were advised that it was not prudent to separate generation from distribution altogether, and therefore it was asked that the four companies should be allowed to amalgamate, or form one big company to control the whole of the undertakings. The companies were in negotiation with the L.C.C., and he hoped to announce later that an agreement had been come to on the lines of the agreement which had been discussed in connection with No. 2 Bill, involving the sliding scale. The Bill also gave a period of 12 months within which an amalgamation scheme should be brought forward, and an agreement had been entered into between the four companies in this connection, any transfer of lease under the agreement having to be sanctioned by the Electricity Commissioners. With regard to Clause 13, which provides for the appointment of a technical committee, counsel pressed this as being very important from the point of view of the reorganisation of the electricity supply in London. In view of the decision of the Committee in the previous Bill, Counsel said he felt in a difficulty, but it was extremely doubtful whether the Electricity Commissioners could legally require the Joint Electricity Authority to appoint a technical committee. Therefore it would be of the greatest possible value if the Committee could direct in this Bill that a technical committee should be formed consisting of the representatives as set out in the draft Order of the Electricity Commissioners. Otherwise there was a danger of the companies not securing proper representation on any technical committee that might be formed ultimately. His clients took a stronger view on this matter than the promoters of No. 2 Bill, and he asked the Committee to give careful consideration to this point.

The North Metropolitan Electric Power Supply Co. opposed on the ground of competition; Camberwell Borough Council appeared in respect of the special purchase powers over the companies in that area, and other opponents were the promoters of No. 2 Bill, the L.C.C., West Ham, East Ham, and some smaller authorities.

Mr. C. H. MERZ, of Messrs. Merz & McLellan, consulting engineers to the County of London Electric Supply Co., and also to the four companies concerned in the present Bill, said it was proposed gradually to close down the City Road, Wandsworth, and Loughborough Junction power stations, and partially to shut down the Blackwall Point station. The units generated during the year following the cessation of the war, by the four companies, amounted to 124 millions, but this had increased to 183 million units in 1923, a figure which would have been larger had the Barking station been sanctioned without the delay that had actually occurred. The first stage of the Barking station was for 200,000 kW, the initial plant now being installed having a capacity of just under 100,000 kW. The transmission voltage was 33,000 volts, and a ring main had been laid to give supply to various points. A tunnel was built under the Thames at Barking for giving a supply in the south of London. Having regard to the Barking power station, the area as a whole was better served than the area of the other ten companies. The industrial demands in the promoters' area were extremely great, and had hardly been developed yet. He anticipated that the maximum demand in the area of the four companies would amount to 400,000 kW within ten years. Bankside would only be extended to 60,000 kW, and all the rest would be dealt with from Barking, where there were facilities for extending to 600,000 kW. Perhaps before that stage was reached, however, it would be necessary to start a new station. Mr. Merz expressed himself strongly against separating generation from distribution, and added that this scheme would be the nucleus for the proper generation and distribution of electricity in London. Although at present the cost of generation in the case of the four companies was a little higher than that of the other companies, when Barking was developed the cost would come down to half the present figure of 0.88d. per unit, and when the load factor improved to 50 per cent., as it should do in such an industrial area, the cost of generation would be below ¼d. per unit.

Mr. J. B. BRAITHWAITE, chairman of the City of London Electric Lighting Co., then gave evidence, and said that the power to amalgamate with other companies, and the agreement to extend the tenure of the companies for 40 years, would remove the two great handicaps under which the companies now suffered. With these powers the necessary financial arrangements could be made at a very much lower cost than at present.

Mr. CRAIG HENDERSON, K.C., and Sir LYNDEN MACASSEY, K.C., for the North Metropolitan Electric Power Supply Co., and West Ham Corporation, respectively, cross-examined with regard to Clause 15, relating to authority to give a supply to railway companies for use outside the area of the promoters. No opposition was offered to the supply for traction purposes, but objection was taken to the supply so given being used for lighting stations in outside areas. The promoters of No. 2 Bill had agreed to exclude station lighting.

The matter was left over for discussion among the parties. This closed the case for the promoters.

On Friday, May 23rd, Sir JOHN SNELL, Chief Electricity Commissioner, was called by the Committee to speak with regard to the proposed clause dealing with the appointment of a Technical Committee. Sir John said the matter had been further considered, and the proposed clause was now put forward in the following terms:—"Notwithstanding anything in the Electricity Supply Acts, 1882-1922, the Commissioners may direct the Joint Authority to appoint a Technical Advisory Committee consisting of duly qualified persons, and exercising such functions as the Joint Authority, subject to the approval of the Commissioners, may determine." He said that he did not regard the clause as an integral part of the Bill, but it would be a useful addition to the machinery for working the Commissioners' scheme.

Sir LYNDEN MACASSEY, K.C., said the Commissioners were doubtful of the powers they had under the general law, and were attempting to obtain wider powers than they now had, by means of a clause in a private Bill. The compulsory appointment of a Technical Committee was struck out of the draft Order by the Commissioners at the recent inquiry, and the opponents went away satisfied.

Owing to the incomplete state of the negotiations with the L.C.C., the further consideration of the Bill was adjourned.

North Metropolitan Electric Power Supply Co.'s Bill.

The consideration of the North Metropolitan Co.'s Bill was then proceeded with.

Sir LYNDEN MACASSEY, K.C., who appeared for the promoters, with Mr. Craig Henderson, K.C., and Mr. Beveridge, related how the company was incorporated in 1900 as a power company with an area comprising parts of Middlesex, Hertfordshire, and Essex. The capital of the company originally was £500,000, but now it was £1,200,000 ordinary and preference capital with £546,700 mortgage capital and debenture stock, a total of £1,746,700, and the business of the company had developed enormously. The company's area was 326 sq. miles, in which there were four generating stations, *viz.*, at Brimsdown, Willesden, Hertford, and St. Albans. All these stations were linked up, or in process of being linked, and in this way the company had anticipated a great deal of the technical scheme. The capital expenditure during the past three years had been over £640,000, and the energy sold during 1923 was 79,000,000 kWh, compared with a figure of 1,800,000 kWh, which was regarded as a good one before the war. Counsel referred to the large number of local authorities now supplied in bulk in the area, to the large tramway system in Middlesex, and to large power users. The company had taken over a number of electric lighting provisional orders, and had also obtained a number of provisional orders itself. There was an increasing actual demand in the area, and a large potential demand in the several suburban railways, which would eventually adopt electric traction. As a consequence, the company found itself faced with the need for additional generating plant and land, and the necessary further capital. The Bill sought for additional areas in Essex and Hertfordshire where a supply was required. Among the other provisions of the Bill was one which repealed a provision in the company's Act of 1909 giving the local authorities the right to purchase any mains in a district, laid for lighting purposes only. This was regarded as not in the interests of either local authorities or the company. Another important provision of the Bill was one which removed the veto of the local authorities upon supply by the company, and its replacement by an appeal to the Electricity Commissioners in case of refusal to give consent. All this had been done by agreement with the local authorities. As regarded the new area now proposed, the maximum price of lighting was to be increased from 7d. to 10d. per kWh, with revision under the terms of the Electricity Supply Act of 1922. The new capital powers asked for were £500,000 nominal capital, with £640,000 borrowing powers. In Clause 28 an important amendment to the existing powers of the company was indicated, *viz.*, that an arbitrator, called upon to determine the price to be charged to a power user, should have regard to the maximum demand and not only to the energy required.

Sir LYNDEN MACASSEY then made a long reference to a report on the Bill by the Ministry of Transport on the advice of the Electricity Commissioners. The first point dealt with was the comment of the Ministry that the North Metropolitan Electric Power Supply Co. worked under so many complicated Acts of Parliament that a consolidation Bill should be introduced by the company in order to avoid the difficulties of legislation by reference. Another point was that the new areas proposed to be added to the company's area in Essex should not be added for the reason that this might complicate the position later when the Joint Electricity Authority came to be appointed. Counsel objected to this attitude on the part of the Ministry of Transport, and said that presumably these areas, which wanted a supply, and could have it at once, were to be made to await the possible appointment of a Joint Electricity Authority—which might never be done. Moreover, under the draft Order now receiving the consideration of the Commissioners, the power companies were to be free, and the Joint Electricity Authority could not function in their areas, so that, in order to give a supply to these additional areas in Essex on the fringe of the North Metropolitan Co.'s area, the Joint Electricity Authority would either have to lay duplicate mains through the company's existing area or take a supply from the Power Co. itself and peddle it out to the areas concerned. Such a procedure would be wholly unbusinesslike, and he asked the Committee to add these areas to the company's existing area. With regard to another suggestion in the report, counsel protested vigorously against the granting of power to the Minister of Transport to revoke the company's powers in certain circumstances. The effect of the inclusion of such a power would be most serious as regarded raising capital, whilst all the company's capital in the past had been raised without there being such a clause in any of the company's Acts.

There were three opponents to the Bill. Major J. W. King, an estate owner in North and South Mimms, had a generating station which supplied the property on the estate, and the objection was to competition and power to break up private streets. Another objection was by the Luton Corporation, which was applying for special orders for certain districts outside Luton, and now asked to be added to the area of the North Metropolitan Electric Power Supply Co. The third petition was that of the County of London Co., but this was allowed to stand over for the present owing to negotiations going on.

Sir JAMES DEVONSHIRE, chairman and managing director of the North Metropolitan Electric Power Supply Co., said that the total capacity of the four generating stations mentioned was 51,000 kW, and, in conjunction with these, there were 112 sub-stations. Dealing with the Minister of Transport's recommendation that the new areas in Essex should be dealt with by a Special Order, Sir James Devonshire pointed out that the Joint Electricity Authority could not function, because under the Electricity Supply Act of 1922 an adjoining authority could not enter the area of a power company. Moreover, all the local authorities concerned supported the company's Bill. The land to be acquired under the Bill was adjacent to the existing Brimsdown station, and the Electricity Commissioners had expressed the view that the land in question was suitable. Moreover, the extension of the Brimsdown power house was part of the technical scheme in the draft Order of the Electricity Commissioners. With regard to the new capital powers, the company had works in hand this year involving an expenditure of £200,000. The borrowing powers proposed under the Bill were in excess of the usual one-half of the ordinary capital in order to obtain the advantages of the Trade Facilities Act, which enabled the debentures to be placed at a much lower rate of interest. The Trade Facilities people had rather encouraged him to proceed with the proposal on account of the unemployment question. Under the Trade Facilities Act assistance was only given in respect of debentures. Referring to the suggestion of the Ministry of Transport that it would be wise to provide a Consolidation Act, Sir James said this would involve expense, and none of the local authorities in the area had asked for anything of the kind to be done, but he was willing to give an undertaking to promote such a Bill within the next three sessions of Parliament, on the understanding that no attempt was made to interfere in any way, in that Bill, with the existing powers of the company. The opposition of the County of London Co. was against the North Metropolitan Co.'s proposal to take in part of Essex, whilst the County of London Co. was in its Bill, which would come on next, asking to be made a power company to supply the whole of Essex. As, however, the North Metropolitan Co. was already supplying in parts of Essex, a point would have to be decided there first, because it was not usual for power companies to be allowed to compete in each other's areas.

The Hon. EVAN CHARTERIS, K.C., cross-examining for the Luton Corporation, said the Corporation was negotiating with the Electric Supply Corporation, the holders of the Hitchin Order, for a supply in bulk, but the present Bill would put the Power Co. in a position to interfere with this arrangement.

Sir JAMES DEVONSHIRE said he wished to supply Hitchin himself, and he had agreed with the Hertfordshire County Council to include Hitchin.

Mr. CHARTERIS said that at the present moment the Power Co. was taking a supply from the Luton Corporation for use in St. Albans.

Sir JAMES DEVONSHIRE said that he was actually negotiating with the Electric Supply Corporation for a supply in Hitchin, and was given to understand that the Hertfordshire County Council did not want Luton supplying in the county, and actually wanted the company to give the supply.

On Tuesday, May 27th, Sir JAMES DEVONSHIRE was cross-examined by Mr. TYLDESLEY JONES, K.C., for the promoters of the next Bill in the list—the County of London Electric Supply Co. The cross-examination related mainly to Bishops Stortford and the Epping Rural District, through which the North Metropolitan Co. wishes to lay mains. The principal point was as to supply to railway companies. Already the North Metropolitan Co. can supply the Great Eastern and Great Northern railway companies in its present area for use outside, but Mr. Tyldesley Jones was anxious to know whether under the Bill the North Metropolitan Co. was seeking to be able to supply railway companies which it could not supply at present. Sir James said that was not the intention, but he wished to have the power to lay mains through Epping Rural District and Bishops Stortford for engineering reasons. Certain areas in which there would have been competition between the North Metropolitan and County of London Companies have been struck out of the latter's Bill.

With regard to the position in North and South Mimms, Mr. BIDDER, counsel for Major King, cross-examined to the effect that repeated requests had been made to the North Metropolitan Co. during the past three or four years for a supply to be given in the Potters Bar district, but they had always been refused on the ground that it would not pay. In the end, Major King applied for a Special Order for this district, with the intention of forming a company to work it, and the North Metropolitan Co. was opposing that Order before the Electricity Commissioners.

Sir JAMES DEVONSHIRE said that at the present time the Order had been given for the necessary cables, and notices had been served on the local authority for laying a main between Barnet and Potters Bar. The company would provide a supply this autumn. He admitted, however, that no one would be able to demand a supply from the company for lighting purposes.

In re-examination, Sir JAMES DEVONSHIRE expressed the view that all power companies or others supplying railways should have the right to supply not only for traction within and without the area of the supplying authority, but also for lighting, signals, and any purposes for which the railway company required to use electrical energy. In these days, when everyone was trying to extend the uses of electricity, the present restrictions upon the use of electricity by railway

companies when the supply was taken from another area ought to be removed.

At this point the consideration of the North Metropolitan Bill was adjourned in order to take clauses in the No. 2 Bill promoted by the ten West End companies.

London Electricity Supply (No. 2) Bill.

The Committee then considered clauses in this Bill, the preamble of which was declared proved last week.

During the interval adjustments had been made in the clauses which had had the effect of removing all opposition, whilst the agreement with the London County Council including the sliding scale had been sealed and exchanged. Thus the Bill went forward in its original form so far as the main scheme was concerned, with the modifications in clauses referred to. The opposition of the West Ham Corporation and a number of others with regard to railway supply had been removed by the insertion of words to the effect that power supplied by the ten companies in their area for traction purposes might be used for those purposes outside their area but not for lighting, &c., without the consent of the authorised distributor. There was a long discussion with regard to the area mentioned in the Bill being, for certain purposes, the county of London, but the L.C.C. strongly objected to this, and the Committee decided that the area for all purposes must be the areas of the ten existing companies. All reference to the Technical Scheme was cut out of the Bill, in accordance with a previous decision of the Committee. A point brought up in the discussion of clauses was that it had been agreed to sell the Willesden power station of the Metropolitan Electric Power Supply Co. to the new company to be formed under the Bill. This station, of course, is not in London, and at present is not purchasable by anybody, but it was thought to be in the interests of the whole scheme that the power station should be in the same hands as the others belonging to the ten companies.

The Bill, which thus provides for the amalgamation of the ten West End companies, the formation of a separate company to take over the whole of the generation (leaving the individual companies to carry out the distribution), the extension of the life of the companies till 1971, and the application of the sliding scale of dividends and prices, was then reported for third reading. *(To be continued.)*

Power Circuit Interference with Telegraphs and Telephones.

Discussion at Liverpool.

MR. S. C. BARTHOLOMEW's paper on the above subject* was read at the Mersey and North Wales (Liverpool) Centre of the INSTITUTION OF ELECTRICAL ENGINEERS on April 28th, and in the subsequent discussion

Mr. A. J. EAMES suggested that the chief responsibility for preventing interference with communication circuits must rest necessarily with power engineers and designers, whose efforts in that direction should be supported by the application of such remedies as were within the means of telegraph and telephone engineers; the successful elimination of power interference depended largely upon effective co-operation and goodwill between all the parties concerned. There was not a very great deal that communication engineers could effect, beyond seeing that their plant was well constructed and maintained, that telephone circuits were satisfactorily balanced, and assisting in keeping communication and power circuits as far apart as was practicable. The most effective method of eliminating the effects of induction was to adopt the best construction and maintenance standards. There appeared to be some tendency to use the word "minimising" rather too freely with reference to this subject. The considerable development of the telephone service that was expected to take place in the congested South Lancashire district during the next few years could only be met by the liberal provision of a suitably-designed all-underground service. This would materially help to solve the inductive problem—at least locally. Leakage and disturbance from distant power circuits should be remedied at the source; in other words, the disturbing harmonic frequencies ought to be eliminated by improvement in the design of power plant. British authorities were entitled to claim credit for the foresight exercised in establishing safeguards in anticipation of what would be likely to happen if irresponsible people were allowed a free hand. In fact, the regulatons ensured protection for the plant of all properly-constituted power and communication engineering authorities alike, in preventing chaotic conditions arising. The method described by Prof. E. W. Marchant in the appendix for overcoming interference was applied with marked success at Liverpool. Harmonic frequency trouble caused by a mercury-arc rectifier might be accentuated where electric lighting services were installed in the same buildings, and where there might be damp walls. With regard to the transposition of telephone wires, would it not be advantageous to revert to continuous transposition (the wires making a complete revolution every four spans) where there was parallelism with a traction system? Could a search coil be usefully employed in connection with laying ducts with the aid of a thrust-boring machine for tracing the positions of high-pressure mains?

Mr. T. CORNFOOT mentioned that electrolytic disturbance was one of the most difficult to locate because, while the other disturbances described made themselves felt at once in telegraph circuits, or could be heard in telephone circuits, electrolytic action did not make itself manifest until very material and irrepairable damage had been done.

Prof. E. W. MARCHANT said that one of the most interesting things in the paper was Mr. Gill's curve, fig. 1, showing the audible effect of different frequencies of current. The enormous difference between the effect produced by a sound due to a current of 50 cycles and that due to a current of 1,000 or 1,100 cycles was very remarkable. The figures quoted as given by Osborne in the *Proceedings* of the American Institute of Electrical Engineers would be subject to variation in different individuals, and it would be a valuable piece of investigation if some such records could be obtained for a number of different people. As a rule, older people could hear high-pitched sounds less clearly than younger people. In some experiments that were being made in the laboratory a few months ago, he found that one of his students was able to hear a sound of over 12,000 frequency, which was entirely inaudible to him.

Mr. W. FENNELL said that he was interested in the running of a number of miles of e.h.p. transmission and distribution lines, and his experiences so far indicated that eventually a slightly different, and more reasonable, attitude would be taken up by the Post Office with regard to the matter. He called attention to a statement in the paper on page 23 to the effect that if telephone lines were perfect as to design and maintenance, they would not be affected by induction from power or other lines, which suggested that the Post Office was asking others to pay for Post Office deficiencies. The Post Office had, in general, come in first, and had covered the country with absolutely unprotected overhead circuits, so that if the power engineer was asked to supply power to the inhabitants, say, of an area like the Wirral Peninsula—which could only be dealt with economically by overhead lines—there would be tremendous trouble and expense, involving high charges for electricity, if the Post Office was not accommodating. The public interest, in fact, should come before departmental interests. He considered that electric power lines, and especially electric railway lines, in this country were in general more important than telephones, and the Post Office could not fairly claim to continue to follow railway routes when by so doing it would impede, or even prevent, railway electrification. The same applied to some extent to public roads in relation to electric power and light. In Cheshire there was a 50-period overhead distribution system for an outlying residential district wherein some consumers insisted that the service lines should go underground from the nearest pole into the residences. The underground services were not properly sealed at the pole, and moisture entered the cables, causing rapid deterioration. When the faults occurred, the local exchange indicators dropped, and investigation showed that the reason was that neither the electricity supply company nor the Post Office had efficient earth connections, due to the sandy nature of the soil in the locality. Mr. Fennell called special attention to the tremendous effect which an earthed guard wire had on shielding; figures were given in the paper as to the efficiency of one earthed wire along the side of an electric railway between the power and telephone lines, and he submitted that most cases of static interferences, due to proximity, could be dealt with economically by this method, and no dangerous charging of message wires would be possible if an earthed wire was fixed to each telephone or telegraph cross-arm on the side facing the power line or tramway. The guard wires could be looked upon as the equivalent of armouring and outside insulation, and it would be well if the Post Office followed the principle of each authority providing at its own cost such means as it thought fit to protect its own plant.

Mr. C. J. MERCER (P.O. Engineering Department, Liverpool) said the paper would have served a most useful purpose if it resulted in co-operation between power and telegraph

*ELEC. REV., April 18th, 1924.

and telephone engineers to prevent interference at the source. A case of interference being carried over a wide area was that of a 7,000-volt, 3-phase system with overhead transmission erected parallel with telegraph wires, carried on railway poles. The working of the telegraphs was not adversely affected, but the telegraph wires diverged to other routes and interference was transmitted by tertiary induction to telephone lines which did not themselves approach the power lines. He had heard the distinctive note of such interference more than a hundred miles from the power lines. The trouble was clearly due to harmonics.

Mr. L. BREACH said that, looking at fig. 43, which referred to the neutral currents on the Newcastle Electric Supply Co.'s system, it was not clear where the system was earthed when the tests were made. The author referred to the earth neutral as an accomplished fact, and stated that "in addition" an earth might be required in connection with the operation of protective gear on the power system. What was meant by the second earth? Referring to the appendix, the rectifier caused disturbances on the telephone circuits when operating on the traction as well as on the lighting systems. The disturbance had, however, been entirely eliminated by the method shown.

Mr. J. A. MORTON explained that it had been stated in the paper that with the usual 3-phase power lines in this country having balanced currents and voltages, and being mostly untapped lines, the interference with open communication wires was at present very small; but in the future the situation might alter. There were likely to be many high-pressure lines in sparsely-populated and agricultural districts where nothing but an overhead line would pay, where the load would be taken off at irregular intervals and of quite small amounts, being almost certainly single-phase loads. This being the case, the currents and voltages in the 3-phase transmission line would be unbalanced in different parts of the lines and the possibilities of interference increased, unless the Post Office by then had put its circuits underground where they should be. With regard to the question of bare telephone wires carried on the same poles with, and underneath, power lines, it was quite possible to get good speech through such wires providing they were continuously revolved and that the insulation was maintained in a high condition, although such telephone lines were likely to be of little use when most wanted; that was to say, when something happened to the power line itself. The best practice was to put the telephone wires in a lead-covered cable, the wires being paired and paper insulated in the ordinary way, and the lead covering of the cable earthed. The telephone cable was usually suspended from the longitudinal steel earth wire, which was also earthed, and which itself acted as an efficient earthed screen between the telephone cable and the power wires. He had never heard of any dangerous voltages being induced in a telephone cable carried in that way. The suggestion for a change in earth connections was a useful one, as had been found by their radio friends, who in some cases had cut down buzzing in their receivers by taking the earth off the water system, which acted as a sort of collector of stray currents, and sinking an old bucket as a separate earth in their back garden. Dr. Marchant, on his first slide, showed how the capacity current in a power system might cause interference even with only one definite earth on the system, but the protective gear pilot circuit was usually physically separate from the power circuit, and the capacity current in a protective pilot cable must surely be too small anyhow to cause interference. There was, however, one form of protective system in which each pilot conductor used in connection with the protective gear had an insulated copper earth sheath round it which carried the capacity current back to the station, so that in this case it never got to the earth at all, and could not cause interference. One thing which was clear was the necessity on both power and telephone lines of having the insulation as perfect as possible. Insulators got covered with soot or salt, and not sufficient was done to properly maintain the line insulation. Leakage caused in this way would affect the communication circuits in the neighbourhood, but possibly the Post Office itself would get less interference if the insulation of its own lines and instruments were better maintained.

Mr. F. J. TEAGO said that fig. 1 was the most interesting part of the paper. Further research along those lines might well be carried out in order to ascertain whether the interference curves for other types of receiving apparatus differed materially from fig. 1. Having a set of typical interference curves, one could endeavour, in the design of electrical generating machinery, to avoid those harmonics which produced peak values of interference. Fig. 1 appeared to suggest that the reason why d.c. machinery did not interfere to the same extent as a.c. machinery was that the harmonics in the d.c. case were high and beyond the peak, whilst in the a.c. case they were low and between zero and the peak. To eliminate harmonics from electrical machinery to the extent desired by the author would be a difficult and expensive matter; self help was usually the most effective form of assistance.

Mr. C. RETTIE asked if there was more trouble with three-phase than with single-phase lines. He should imagine, for instance, that in a three-phase system with an underground neutral a partial earth would cause a lot of trouble. Troubles arose from d.c. systems as well as alternating ones, so that the advantages of one system over another for the electrification of railroads were minimised on that account.

Italy's Electrical Trade.

THE following statement, showing the imports into and exports from Italy of electrical goods during 1923, has been compiled from the recently-issued official trade statistics. The figures for 1922 are added for purposes of comparison and notes of any increases or decreases are made.

IMPORTS.

	1922. Quintals.	1923. Quintals.	Inc. or Dec. Quintals.
Electric generators and motors.—			
Total	20,220	15,500	– 4,720
From Austria	1,000	800	– 200
,, Germany	11,000	8,100	+ 2,900
,, Great Britain ...	2,200	900	– 1,300
,, Hungary	1,600	4,000	+ 2,400
,, United States ...	3,400	200	– 3,200
Static transformers.—			
Total	11,600	8,700	– 2,900
From Austria	670	200	– 470
,, Germany	7,500	6,400	– 1,100
,, Germany (Reparation account)	1,300	20	– 1,280
,, United States ...	1,500	700	– 800
Electricity meters.—			
Total	5,500	8,000	+ 2,500
From Germany	4,600	7,000	+ 2,400
Telegraph and telephone apparatus.—			
Total	1,500	3,500	+ 2,000
From Germany	700	2,800	+ 2,100
,, United States ...	400	30	– 370
,, Belgium	—	300	+ 300
Carbons, electric.—			
Total	25,000	43,000	+ 18,000
From Germany	11,000	16,500	+ 5,500
,, Yugoslavia	4,000	9,000	+ 5,000
,, United States ...	7,000	15,000	+ 8,000
Insulators, porcelain, &c.—			
Total	12,000	14,000	+ 2,000
From Germany	7,900	6,800	– 1,100
,, United States ...	3,600	4,700	+ 1,100
Steam boilers.—			
Total	22,200	29,200	+ 7,000
From Germany	15,400	25,700	+ 10,300
,, Great Britain ...	3,600	500	– 3,100
,, Czecho-Slovakia ...	1,700	—	– 1,700
,, Switzerland	—	1,000	+ 1,000
Electric lamps.—	(Thousands.)	(Thousands.)	
Total	14,332	12,688	– 1,644
From Austria	2,855	2,368	– 487
,, Germany	3,145	2,067	– 1,078
,, ,, (reparations)	359	1,162	+ 803
,, Holland	5,856	5,248	– 608
,, Switzerland	1,506	1,231	– 275
,, Hungary	—	458	+ 458
	(Quintals.)	(Quintals.)	
Insulated electric wire or cable, covered with rubber or textile	420	680	+ 260
Ditto, armoured, including submarine cables	1,900	2,100	+ 200

EXPORTS.

	1922. Quintals.	1923. Quintals.	Inc. or Dec. Quintals.
**Insulated electric wire* or cable, covered with rubber or textile	4,000	3,400	– 600
*Ditto, armoured, including submarine cable	6,700	21,700	+ 15,000
Electric generators and motors.—			
Total	15,700	16,200	+ 500
To Belgium	1,700	2,000	+ 300
,, France	1,800	1,800	—
,, Spain	1,000	1,900	+ 900
,, India	1,900	2,700	+ 800
,, Somaliland	1,000	—	– 1,000
,, Argentine	1,800	2,600	+ 800
,, Brazil	2,900	2,200	– 700
Electric lamps.—	(Thousands.)	(Thousands.)	
	76,000	54,200	– 21,800
	(Quintals.)	(Quintals.)	
Static transformers	400	3,600	+ 3,200
Accumulators	2,300	900	– 1,400
Magnetos	344	488	+ 144
Electricity meters	46	30	– 16
Telegraph and telephone apparatus	521	71	– 450
Insulators, porcelain, &c. ...	700	345	– 355

* Principal destinations, Switzerland, India and Spain in 1922, and Peru, Argentine and Switzerland in 1923.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

An Adjustable Cast-iron Switch Box.

We have received from BESTWAY SPECIALITIES, LTD., 4, Queen Street, Blackpool, a sample of a new adjustable cast-iron box for tumbler switches which it has produced (fig. 1). This is a rectangular box, fitted with a lug and a conduit grip, in the back of which is a plate secured to the box by a stud. The periphery of this plate is slotted, and a tumbler switch body of any make can be fixed to it by means of small screws and nuts. Rotation of the plate and switch is prevented by a stop screwed into the back of the box which engages with a further slot in the plate. The method of mounting the

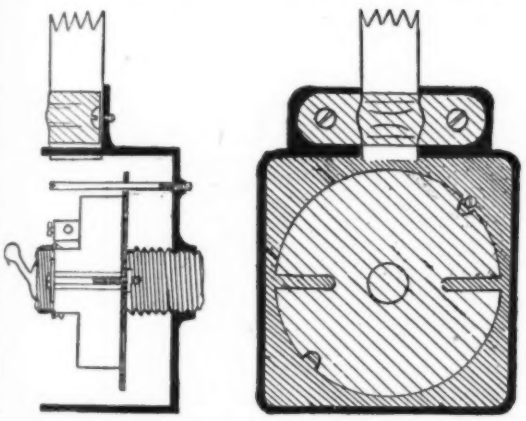

Fig. 1.—An Adjustable Cast-Iron Switch Box.

switch on a stud enables its height to be adjusted to the extent of ¾ in. to allow for variation in the depth of plaster, &c. The box is fitted with a plain c.i. cover or a switch plate of other metals as required. It is made for screwed or grip conduit and in several types, including "back outlet" and "straight through." A factory-type box with similar features is also made; this is fitted with a plain c.i. cover and has the tube inlet at the rear of the box to allow the tube to be kept flush on the wall.

Twenty-four-Hour Heating Loads.

The system of supplying a comparatively small wattage for practically 24 hours of the day in connection with a water heater of the storage type is being adopted by a good many supply undertakings. Energy supplied in this manner can be charged for at a comparatively low rate, and it is found that hot water can thus be obtained at a price which competes with other modes of heating.

A difficulty which sometimes arises in connection with this system is that the supply authority is not willing or able to furnish this extra load during its peak hours, namely, the hours of heaviest lighting load.

MESSRS. ELECTRICAL UTILITIES, LTD., of Tudor Works, Park Royal, London, N.W.10, who manufacture the well-known "Utility" current limiter, have placed on the market an instrument which, at little cost, provides a solution to this difficulty. The device consists of a standard "Utility" limiter, the operating coil of which is connected to the lighting circuit which is metered, whilst the operating switch portion of the limiter is connected in series wth the 24-hour load. It is thus arranged that when a consumer switches on more than a predetermined number of lamps, the relay automatically cuts off the heating-circuit supply until the number of lamps in use is reduced. By this means an increase in the maximum demand is avoided without interfering with the continuous supply of hot water. The instrument in question is standard in all particulars, with the exception of the rearrangement of the wiring circuits as described above, and as "Utility" limiters have been widely adopted and in service for several years, it is claimed that absolute reliability is assured.

By the adoption of the 24-hour heating system, in conjunction with the "Utility" series relay, a remunerative load can be secured by the supply system. The lighting current at which the 24-hour load is cut off can be varied as may be desired. Thus, a 3-ampere, 24-hour heating load can be provided, and it can be arranged that it is cut off when the lighting current rises to 1, 2, 3, 4 amperes or more.

New Police Lantern.

Metropolitan police constables are being equipped with a new type of electric lantern, designed by Mr. G. A. H. WOOTTON, chief of the Engineering Section, New Scotland Yard.

It is claimed that the new lantern is not only a great improvement on the one issued about four years ago, but that the maintenance cost is considerably less. The lantern is constructed of aluminium, and is acid proof. There is an ingenious chamber for a spare bulb, and by means of a simple focusing arrangement the light can be used either as a concentrated beam or for wide-angle illumination. When the beam is used, objects are easily visible at 100 yd. distance, and for the purpose of inspecting window-fastenings and doors of houses at night this is invaluable. The current consumption is .75 A at two volts, and a continuous light can be maintained for ten hours on one charge.

The handles fold back, so that the lantern hugs the body, while a special form of belt-clip prevents the lantern from being removed by anyone other than the wearer. Up to the present, 300 of the new lanterns have been supplied, and the whole force will be equipped as soon as possible.—*The Times.*

The Buck Rotary Tumbler Switch.

A notable departure from customary practice has been made by Mr. J. W. Buck in his rotary tumbler switch, which is made by the J. W. BUCK SWITCH CO., of 39, Victoria Street, Westminster, S.W.1. Retaining the outward appearance and dimensions of the ordinary tumbler switch, he has inserted a pivoted contact blade which rotates in a plane parallel to the base of the switch, and is actuated by a simple attachment to the dolly. As shown in the accompanying figure, the fixed contacts are at opposite ends of a diameter, 1¼ inches apart; the contacts are separate pieces of phosphor-bronze, separated by spacing washers, a method which ensures accurate spacing and therefore good contact, and the contact blade has a rapid rotary movement under the action of a flat steel spring, which is under compression only whilst the switch is being operated and is stressed far below its ultimate strength. In action a lever insulated from the switch blade by a small roller, but pressed against the blade by the spring,

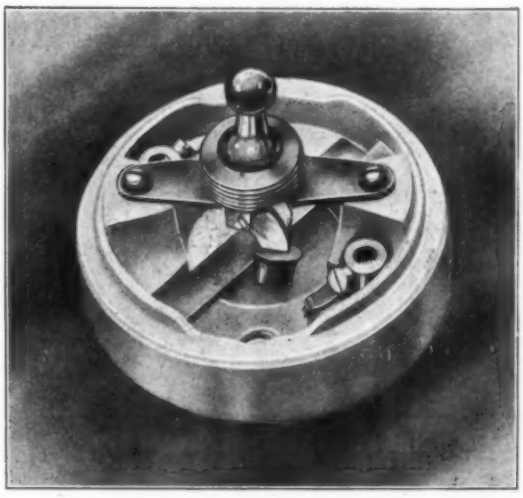

Fig. 2.—The Buck Rotary Switch.

is moved along the side of the switch blade by the dolly, and throws the blade over when the roller passes the dead centre. The action is very smooth and lively, and we are informed that durability tests have been made involving many thousands of cycles without producing appreciable wear on the parts or other defects. The switch breaks on both poles, and the length of break is exceptionally great. It is made at present in the 5-ampere size, and it is stated that it will carry and break its full rated current in continuous use, being therefore suitable for mounting on heating apparatus up to that current value and for use with gasfilled lamps. Three- and 10-ampere sizes are in course of production, and both flat and flush patterns are made, with various covers, and bases of English vitreous porcelain. In other respects sample switches which we have inspected are of good workmanship and material.

The Kelvin Centenary.—The centenary of Lord Kelvin's birth will be celebrated at Glasgow University on Commemoration Day, June 25th, when the honorary degree of Doctor of Laws will be conferred on the Prime Minister, Sir James Bell, and Dr. Alexander Russell, president, I.E.E.

Correspondence.

***Correspondents should forward their communications* at the earliest possible moment.** *No letter can be published unless we have the writer's name and address in our possession.*

Pulverised Coal.

Mr. Edgell's letter in your issue of May 16th mistakenly asserts that pulverising equipment is being installed in practically all new large construction in America and in Canada.

Actually, direct stoker firing of untreated coal is adopted for the huge extensions of the Commonwealth Edison Co., Chicago; for the sixteen 19,743 sq. ft. boilers of the new Weymouth plant of the Boston Edison Co.; for the twelve 19,650 sq. ft. boilers of the new Hudson Avenue plant of Brooklyn Edison Co.; for the 15 23,600 sq. ft. boilers at the Kearny plant of Public Service Corporation; for the large extensions of Philadelphia Electric Co., and very many other modern boiler plants, including the Hell-gate plant in New York to which Mr. Edgell refers.

In the *Proceedings*, May, 1924, of the Junior Institution of Engineers, reporting the discussion on Mr. Jockel's paper on "Water-tube Boilers," a comparison is given (page 375) between the 15-retort Riley stokers on single-ended 23,600-sq.-ft. boilers at Kearny, and the duplex 18-retort Riley stokers on fourteen double-ended 22,600-sq.-ft. boilers at the St. Ouen plant in Paris; and the following reference was made to the recent tests at the Hell-gate extension with a multiple-retort stoker:—

"For comparison with the claims for overload capacity and high efficiency made for pulverised coal, Mr. Erith referred to the recently-published tests at the Hell-gate station in New York for a *stoker-fired* boiler with 15,900 sq. ft. of heating surface, and economiser, but no air heater, showing (for ¾ hour) 528 per cent. American rating, or at the rate of 18.2 lb. per sq. ft. hourly from and at 212 deg. F.; while the normal duty test, at about 80,000 lb. actual steam hourly, showed an efficiency of 84.6 per cent. without, or 92.7 per cent. with economiser. These figures surpassed anything yet claimed for pulverised coal."

A comparison of fig. 3, page 374, of the simple stoker outfit, with fig. 4 on page 376 showing the elaborate plant for drying, pulverising, screening, and spraying pulverised coal and the water-tube slag screens required for the Lopulco system, explains Mr. Evans's admission on page 377 that the total cost of such powdered fuel plant is about double the cost of stoker-firing.

On page 374 reference is made to the fact that there is no occasion for water-tube slag screens for stoker-fired boilers; and it is also remarked that a few installations had recently been made of water-cooled furnace walls for stoker-fired boilers, similar to those introduced many years ago with the Bettington pulverised-coal boiler.

The water-lined walls of a locomotive firebox absorb a considerable proportion of the total heat of the fuel; but the radiation loss is a very small item in modern large-unit water-tube boilers as at Hell-gate, where each of the 15 boilers has a 14-retort stoker 25 ft. wide; twelve of them have ordinary firebrick walls, while the other three have water-screened walls as described by Mr. Edgell. No arches being required with retort-type stokers, radiant heat is transferred direct from the firebed to the tube-bank which forms the inclined roof boundary of the archless furnace, and thus the presence or absence of water-screens for the vertical boundary walls of a furnace 25 ft. wide can have no appreciable effect either on steaming capacity or on thermal efficiency.

The Hell-gate tests appear to give conclusive evidence that nothing could have been gained by adopting the Lopulco system, at double the capital cost of the method actually used, *viz.*, direct firing of untreated moist coal on multiple-retort stokers with an archless furnace setting.

Charles Erith, A.M.I.MECH.E.

London, *May 18th*, 1924.

Pulverised Coal Firing.

I appreciate the criticism of my article "Pulverised Coal Firing *versus* Mechanical Stokers," by Mr. R. H. Allen, in the May 23rd issue of the ELECTRICAL REVIEW. I, too, am not commercially interested in either method of applying the coal to the boiler furnace; at the same time, I am not convinced that the incombustible residue vanishes into thin air when firing powdered coal, and I am also not convinced that any detrimental amount of incombustible residue reaches the stack outlet to atmosphere when firing solid fuel with the mechanical stoker, which does not claim to do the ash-vanishing trick.

We are told that the utilisation of very low-grade coals is one of the main features, and advantages, of powdering the coal before injecting it into the boiler furnace, and as it is necessary to deal with unit weight of coal, irrespective of the grade or method of firing, it stands to reason that when the amount of combustible content is low, the incombustible content must be high.

It is also very significant that we are informed by powdered coal advocates that the ash-handling plant running and labour costs are reduced to a minimum—but no mention is made of how the major portion of the ash is got rid of.

There is nothing remarkable or wonderful in either method of boiler firing. It is the efficiency and the ash disappearance claimed by the so-called superior method of blowing coal dust into the furnace that is entitled to be called wonderful and remarkable, and special consideration appears to be given to figures originating anywhere but in this country.

It still remains to be proved that the instantaneous distillation, carbonisation, and oxidation of a given amount of coal liberates any more heat than the same amount of coal, of the same heat value, going through the same processes less rapidly, which apart from the method of supplying the air, is the only difference between the two methods of heat liberation.

I should certainly be grateful to Mr. Allen for enlightenment on the subject of how to obtain the flexibility and fineness of control of forced or balance draught when operating with induced draught, as a plus pressure under the grate responds more readily to adjustments than the ranging of the minus pressure over the grate.

I should like to make it clear to Mr. Allen that efficiently operated stokers only are taken as a criterion, as it is obviously not fair to compare one method of boiler firing with another on the basis of slip-shod practices which unfortunately still exist in the majority of steam production plants.

The undoubted fact remains that mechanical stokers have proved their worth and do not require flattery and pulverised coal firing is too young to deserve it.

Jarrow-on-Tyne,

W. D. Wylde.

May 26th, 1924.

Applications for Situations.

During the past two years it has been my pleasure to apply for 80 berths between £5 and £7 per week. For 15 of these my experience was exactly the kind required. Yet there has been no reply at all. Why?

(1) Not so clever as I think I am. But my experience some men would envy, and wish they had passed the same examinations.

(2) Too good (see article lately in this journal). [Mr. Chief, please overlook this fault for once.]

(3) Does not know job from top to bottom; give him a month's trial when the foundation is good.

(4) Not enterprising enough. I have used all the enterprise possible between the limits of good sportmanship and "no canvassing allowed" on the one hand and long-dated adverts. on the other.

(5) Berths already filled by quite competent men: Cannot this legal necessity to advertise certain staff appointments be removed? Waiting two months for the postman who is never likely to turn up does not add to the zeal of life.

Horsie.

June 2nd, 1924.

The Domestic Load.

In view of Mr. L. L. Robinson's extremely enlightening article on "Out for the Domestic Businesss," I think that a few remarks from one actually engaged in the duties of a supply undertaking canvasser will be topical.

In his article, Mr. Robinson, amongst other things, laments the apparently nonchalent attitude of the younger members of the electrical profession at the past season's E.D.A. Salesmanship Conferences.

Well, I suggest that if it were possible to hold one or two conferences under the auspices of E.D.A., to be confined in attendance to us temporarily "lesser lights" of the profession, then tongues would wag freely and the ensuing discussions would be delightfully informal, and, what is more, extremely useful.

So far, although I have attended practically every conference since their inauguration, I have, with one or two exceptions, heard nothing of any practical use. It has been merely a repetition of "What *I* did and how cleverly *I* did it" by the writers of the various papers.

There has been practically no mention at all of the little difficulties and human failings to which even the best of us are subject, and I have concluded that as the papers have been read in every case by the older and successful members of the profession, they must have forgotten the trials and tribulations of their earlier struggles for success.

Well, I maintain that this sort of thing creates the wrong atmosphere. It is awe-inspiring! No ordinary young man (probably a little bit nervy about his first public speech) would dare to stand up and discuss his difficulties in front of such an audience of highbrows (especially if his chief was there), because the perfectly natural fear of being considered an inefficient idiot would tie his tongue, and yet I am perfectly certain that we younger members do experience these little difficulties, which a healthly discussion by men in the same boat would considerably help to overcome.

For these reasons, I think that Mr. L. L. Robinson shows a decided lack of understanding of human nature, when he hints that this silence is due to the juniors not having suffi-

cient interest in their jobs, or to use a popular expression not "living" their jobs.

Another idea of his, which I think might be considered from a different point of view, is this: He mentions that the majority of undertakings have got the wrong type of man for a canvasser, and also in another part of his article he has some scathing remarks for the man who lives for pay-day and in fear of the sack.

This brings me to a favourite topic of mine. In the columns of the May 9th issue of the ELECTRICAL REVIEW, under the heading of "Service," I drew attention to the very impecunious position of the average supply authority canvasser, and it is of interest to note that, to date, nobody in a position to do so has refuted any of my statements.

On the contrary, the Walsall Corporation has, by means of an advertisement appearing this week, confirmed my views. It advertises the post of sales canvasser, and is willing (?) to give preference to a man with experience in domestic electrical apparatus and installation details. For this situation it offers the magnificent inclusive salary of £175 per annum (and does not even admonish you not to spend it all at once).

Surely this is all wrong! There should be no question of giving preference to a man with experience, as it would be the height of lunacy to give the job to a man without it. And the salary!

I should like to know what sort of technical, well-educated, well-bred, experienced man would take a job which would probably mean living in "diggings" (an expensive item these days) at this ridiculously inadequate wage, and after all, the above-mentioned qualifications are essential.

No! This sort of thing will attract some out-of-work third-rate commercial traveller, who will look forward to pay-day because of the urgent need for money (little as it is) and who will go in fear of the sack because he knows in his own mind that he is really unsuited to the job, and dreads the hopeless, lonely, nerve-racking feeling of being out of work.

Can he "live" his job under such conditions! Let Mr. L. L. Robinson and other chief engineers and managers drawing salaries of £1,000 a year and more, try to live on £3 10s. a week, and out of this magnificent sum try to save sufficient money to possess man's natural heritage of a wife and home of his own.

Let them try it, and then see if they still have that grand feeling of abundance of spirits and energy to put into their work that they so eloquently preach to the struggling would-be enthusiasts, the canvassers.

En avant.

May 30th, 1924.

It is possible that the Hackney Electrical Department may benefit by misleading advertisements designed to trap admittedly ignorant people into thinking that the "Hackney" brand of volts and amperes differs from those supplied to the national kitchens. I submit that the electrical industry as a whole is done a grave disservice by this class of nonsense.

The reliability of the types of ovens used and the conditions of service being the points at issue, to put up a letter by some unknown lady against the statements of the Ministry of Food seems to me childish, but to claim that because "Hackney" electricity was not used in the national kitchens the test is "beside the mark," is most misleading, to use no stronger term.

Robert A. Sheldon, A.M.I.E.E.

Erdington, Birmingham.
May 29th, 1924.

Positive Predominates!

Some years ago the writer was present at a lecture and demonstration in his classroom at Glasgow University by the late Lord Kelvin, entitled "Electrification of Air." The air of the room was charged positively at one part and negatively at another. Lord Kelvin, having stated that this had been accomplished by means of the apparatus, proceeded to demonstrate the fact. He had in his hand an electrometer, which—holding it at arm's length, while everyone's attention was directed to the pointer—he moved about in front of the audience, reading the observations aloud:—

"Positive, positive, POSITIVE!
POSITIVE PREDOMINATES!
POSITIVE PREDOMINATES!!
POSITIVE PREDOMINATES!!!"

Turning back—"Positive—still positive. Ah! Negative—negative!

NEGATIVE PREDOMINATES!
NEGATIVE PREDOMINATES!"

Turning again—"Negative—positive.
POSITIVE PREDOMINATES!
POSITIVE PREDOMINATES!"

The energy and enthusiasm displayed were things to be remembered. Lord Kelvin, who was slightly lame, thumped the floor with his foot and literally shook the place as he thundered out "Positive predominates!"

I was reminded of this as I heard the speeches at the dinner in honour of Col. Crompton on the occasion of his 80th birthday at the Royal Automobile Club.

It is, I think, 43 years since I mounted the stairs at Mansion House Buildings and offered myself to Col. Crompton. I was an engineering improver, having taken a course at Finsbury under Prof. Ayrton on electricity and magnetism. "You are just the sort of fellow we are looking for," said the Colonel, and he sent me down to Chelmsford.

The enthusiasm of Col. Crompton was not, and is not, second to that of Lord Kelvin. He used to arrive at Arc Works several mornings a week, and "POSITIVE PREDOMINATED" from the moment he entered. We (I was one of the lesser lights, but had a certain facility in connecting and arranging apparatus) worked in red-hot fashion, discussing and arguing technical matters all the time. The train for London was at 1.21 p.m.; until 1.15 p.m. we were invariably in close discussion, when I seized the Colonel's bag and *ran* with him to the station and up the stairs two or *three* at a time as the train steamed in.

As a boy I had been given to understand that it was very dangerous and inadvisable to run to catch a train—people who did so often fell down dead on stepping into the carriage! This evidently is a popular fallacy!

W. Brooks Sayers.

London, *June 2nd*, 1924.

Wood for Underground Conduits.

A new electrical undertaking in which I am interested proposes to lay conduit on some of the underground cable routes to enable additional feeders to be drawn in at a later date, and I shall be interested to learn what your readers' experience has been with wooden duct, such as "Creo pine."

Inquirer.

May 31st, 1924.

A Mysterious Short-circuit.

A few days ago we had a mysterious flash-over on our e.h.p. supply bus-bars, which left fuse marks exactly opposite to one another, and this worried our technical staff considerably as to the cause.

Yesterday the attendant noticed blades of grass and twigs strewn on the floor of the cubicle, which is, of course, securely partitioned off from the rest of the power house, and is kept properly locked. This helped to solve the mystery, as it was then found that birds were building their nests in the timber work of the roof, using the recently-opened louvres for entrance.

One of these nests was promptly taken down, and interlaced with grass and twigs were the enclosed dozen or so copper wires, each measuring about six inches long, evidently taken from an outdoor scrapheap.

It now seems clear that the nest builders dropped one of their "girders" on to the bus-bars immediately below.

We have confiscated the nest, and have closed the louvre windows against aerial trespassers, and hope this experience may be of use to others during the nesting season.

St. Helens Cable & Rubber Co., Ltd.

Slough, *May 27th*, 1924.

Verbose Specifications.

Tenders have recently been asked for two 100-kW converters. The specification issued consists of nearly thirty foolscap pages of printed matter. Have consulting engineers not yet realised that contractors have something else to do than to waste time wading through such things, especially when the amount involved is so small? Only standard material could be offered, and the requirements could have been stated on a quarto sheet of paper.

Erin.

June 2nd, 1924.

Atoms and Isotopes.

By F. W. ASTON, D.Sc.

(*May Lecture read before the* INSTITUTE OF METALS. *Abstract.*)

THAT matter is discontinuous and consists of discrete particles is now an accepted fact, though it is not obvious to the senses on account of the extreme smallness of the particles. Some idea of their size and numbers can be gained by the hypothetical division of a piece of matter into smaller and smaller pieces until the ultimate atom is reached. For this purpose a model decimetre cube of lead is taken and cut in such a manner that after each operation a similar cube of half the linear dimensions and one-eighth the volume results. Modern science shows that this operation can be repeated no fewer than 28 times before the ultimate atom of lead is reached, and that the number of atoms in the original cube is so enormous that, placed in a string as close together as they are in the cad, they would extend over six million miles. Again, if an ordinary evacuated electric light bulb were pierced with an

aperture such that one million molecules of the air entered per second, the pressure in the bulb would not rise to that of the air outside for a hundred million years.

Dalton in his atomic theory postulated that "Atoms of the same element are similar to one another and equal in weight," a simple and definite conception which has been of inestimable value in the development of chemistry. A little later Prout suggested that the atoms of all elements were made of atoms of a primordial substance which he endeavoured to identify with hydrogen. If Dalton and Prout were both right the chemical atomic weights should all be whole numbers, hydrogen being unity. Chemical evidence was against this, and Prout's theory was abandoned for the time. We cannot test the truth of Dalton's postulate by chemical methods, since these require countless myriads of atoms, and, therefore, only give a mean result.

The weights of individual atoms can be investigated by means of the analysis of positive rays, and the early experiments of Sir J. J. Thomson suggested that one element—neon—had atoms of two different weights, but the method of analysis was not accurate enough to prove the point. The requisite accuracy has been obtained by means of an instrument called the "mass-spectrograph." In this the charged atoms in a beam of positive rays are sorted out according to their weight by means of magnetic and electric fields so that they strike a photographic plate at different points. A mixture of atoms of different weights will give a series of focused lines called a mass spectrum, and the relative weights of the atoms can be calculated from the positions of their lines to an accuracy of 1 in 1,000.

As the result of this analysis it has been shown that neon (atomic weight 20.20) is a mixture of atoms of weights 20 and 22; these constituents have identical chemical properties and are called "isotopes." Chlorine (At.Wt. 35.46) is a mixture of isotopic atoms of weights 35 and 37. Half the elements so far analysed turn out to be mixtures, and some are very complex. Thus krypton has six, tin at least seven, and xenon possibly nine constituent isotopes. Recently by means of the method of "accelerated anode rays" the work has been extended to many metals, and already some fifty of the eighty-four known non-radioactive elements have been analysed into their constituent isotopes or shown to be "simple."

Most important of all is the fact arising out of these measurements that all true weights of atoms can be expressed as whole numbers to a very high degree of accuracy. This remarkable generalisation known as the "whole number rule" has removed the last obstacle in the way of a simple unitary theory of matter. We now know that Nature uses the same bricks in the construction of the atoms of all elements, and that these standard bricks are the primordial atoms of positive and negative electricity, protons and electrons.

According to the nucleus theory of the atom first suggested by Sir Ernest Rutherford, which has led to such wonderful advances recently in the hands of Professor Bohr, all the protons, which are much heavier than electrons, are packed with some of the electrons in a central nucleus or sun round which circulate the remaining electrons like planets in orbits. The protons and electrons are so minute compared with the atom itself that it is difficult to indicate their numerical relations. If we were to construct a scale model of the atom as big as the dome of St. Paul's we should have some difficulty in seeing the electrons, which would be little larger than pin heads, while the protons would escape notice altogether as dust particles invisible to the unaided eye. Experimental evidence leaves us no escape from the astounding conclusion that the atom of matter, as a structure, is empty, empty as the solar system, and that what we measure as its spherical boundary really only represents the limiting orbits of its outermost electrons.

All the chemical and spectroscopic properties of an atom depend on the movements of its planetary electrons, and these in their turn depend on the positive electric charge on the central nucleus. In the case of isotopic atoms the net positive charge on their nuclei is the same, giving identical chemical properties, but the total number of protons is different, giving different atomic weights.

Transmutation of one element to another can only be achieved by the disruption of the nucleus. This requires enormous forces, but by the bombardment of atoms by swift alpha particles Rutherford has succeeded in breaking up the nuclei of several of the lighter elements. This transmutation only takes place as the result of a direct hit on the nucleus, the chance of which is only one in many millions. The quantity of matter so transmitted is indeed almost inconceivably small, but it is the first step towards the release and control of the so called "atomic energy." We know now with certainty that four neutral hydrogen atoms weigh appreciably more than one neutral helium atom, though they contain the same units, 4 protons and 4 electrons. If we could transmute hydrogen into helium matter would, therefore, be destroyed and a prodigious quantity of energy would be liberated. The transmutation of the hydrogen contained in one pint of water into helium would see free sufficient energy to propel the *Mauretania* across the Atlantic and back at full speed. With such vast stores of energy at our disposal there would e literally no limit to the material achievements of the human race.

Published Specifications.

Compiled expressly for this journal by Patent Agents.

The name of the applicant's patent agent, if any, will be found on the printed specification.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1922.

13,298. "Electric currents converting machinery." F. Contell. February 10th, 1923. (215,043.)

30,116. "Electrical switches." W. Clark. November 3rd, 1922. (215,387.)

31,145. "Electric switches." Akt. Ges. Brown, Boveri et Cie. December 14th, 1921. (190,454.)

34,276. "Thermally actuated electric switches." C. French and E. French. December 15th, 1922. (215,409.)

1923.

558. "Electric rheostats." A. Linard. January 6th, 1923. (215,412.)

3,307. "Variable electric condensers." G. A. Daubney and E. D. French. February 5th, 1923. (215,424.)

3,661. "Dynamos and motors." M. W. W. Mackie. February 7th, 1923. (215,433.)

3,679. "Telegraph systems." E. S. Heurtley and Muirhead & Co., Ltd. February 7th, 1923. (215,434.)

3,725. "Method of renewing the filaments of thermionic valves employed in radio telegraphy and telephony." J. M. Longe and P. V. Castell-Evans. February 7th, 1923. (215,437.)

3,806. "Alternating current commutator motors." Electro-Dynamic Construction Co., Ltd., and N. Pensabene. February 8th, 1923. (215,441.)

3,952. "Automatic or semi-automatic telephone exchanges." G. H. Janson. February 9th, 1922. (193,049.)

4,101. "Wireless systems and apparatus." J. Robinson and W. H. Derriman. February 12th, 1923. (215,455.)

4,103. "Telephone receivers." R. L. Murray and Telephone Manufacturing Co., Ltd. February 12th, 1923. (215,456.)

4,139. "Connecting devices for radio receiving systems." W. Dubilier. February 12th, 1923. (Addition to 198,318.) (215,458.)

4,191. "Electric stoves, radiators, hot-plates, and the like." H. P. Girling. February 13th, 1923. (215,459.)

4,243. "Telephones." Siemens Bros. & Co., Ltd., E. A. Petithory, and F. Baker. February 13th, 1923. (Addition to 113,565.) (215,461.)

4,371. "Telephone systems." Relay Automatic Telephone Co., Ltd. March 22nd, 1922. (195,356.)

5,274. "Electrical geyser or water-heater." W. Weekes. February 23rd, 1923. (215,480.)

5,527. "Electric glow discharge lamps." Grigg Motor & Engineering Co., Ltd., H. Grigg, and H. Grigg. February 26th, 1923. (215,481.)

5,587. "Temperature-operated electric relays." British Thomson-Houston Co., Ltd. (International General Electric Co.). February 26th, 1923. (215,484.)

5,872. "Process of and apparatus for treating substances in an electric field." L. Heis and H. Jezler. March 2nd, 1922. (194,293.)

6,071. "Automatic transmitters for telegraph systems." Siemens Bros. and Co., Ltd., and A. Gordon. March 2nd, 1923. (215,490.)

6,106. "Construction for locking device for electric incandescent lamps." E. G. Pyne. March 2nd, 1923. (215,492.)

6,275. "Sparking plugs." G. H. Ward and J. White. March 5th, 1923. (215,494.)

7,372. "Variable inductances for wireless telegraphy and telephony." V. S. Roberts. March 14th, 1923. (215,504.)

7,599. "Electrical contacts for weighing scales." Automatic Scale Co., Ltd., and E. L. Blick. March 15th, 1923. (215,505.)

7,746. "Systems of and apparatus for permitting the exact determination of the direction of magnetic or electromagnetic fields of low, medium or high frequency, relatively to a given direction in space." Soc. Industrielle des Procedes W. A. Loth. March 18th, 1922. (195,088.)

8,926. "Lamps suitable for road vehicles, such as automobiles." G. H. C. Butler and A. Reeves. March 29th, 1923. (215,528.)

9,869. "Electric signalling apparatus for railways and the like." L. H. Peter, R. Dell, and Westinghouse Brake & Saxby Signal Co., Ltd. April 14th, 1923. (215,535.)

10,182. "Electrically-heated cooking utensils." H. Bohle. April 14th, 1923. (215,539.)

10,433. "Commutators for dynamo-electric machines and the like purposes." English Electric Co., Ltd., and E. H. H. Hassler. April 17th, 1923. (215,545.)

11,716. "Circuit arrangements in telephone systems employing selecting devices." Siemens Bros. & Co., Ltd., and W. G. Patterson. May 1st, 1923. (215,557.)

13,398. "Plug and socket couplings for electric cables." T. L. R. Cooper. May 18th, 1923. (215,583.)

15,538. "Electrically heated steam and vapour generators." British Thomson-Houston Co., Ltd. (General Electric Co.). June 14th, 1923. (215,611.)

15,895. "Protective devices for vacuum tubes and the like." M. B. Cohen. June 19th, 1923. (215,617.)

20,768. "Induction motors." British Thomson-Houston Co., Ltd. (General Electric Co.). August 15th, 1923. (215,640.)

24,146. "Combined internal-combustion and electric locomotives." Soleur Frères Soc. Anon. October 11th, 1922. (205,478.)

25,668. "Apparatus for the automatic operation of vacuum pumps in large rectifier installations." Akt. Ges. Brown, Boveri et Cie. October 14th, 1922. (205,509.)

29,699. "Insulating cap for cable joints or ends." F. M. Van Gelderen. October 8th, 1923. ((Addition to 210,668.) (215,671.)

29,983. "Choking coils and voltage transformers." E. Pfiffner. November 28th, 1922. (Addition to 173,759, as modified by 190,154.) (207,814.)

30,116. "Gas-filled electric glow lamps with helically wound filaments." Naamloose Vennootschap Philips Gloeilampenfabrieken. December 23rd, 1922. (209,051.)

30,723. "Maximum-current interrupter." A. Woosnam (Herkules Akt. Ges. fur Fabrikation und Handel). December 6th, 1923. (215,678.)

31,032. "Electromagnets." Tyer & Co., Ltd., and F. W. Leake. December 10th, 1923. (215,679.)

31,979. "Process for treating substances in an electric field." L. Heis and H. Jezler. February 28th, 1923. (Divided application on 194,293. Addition to 194,293.) (215,701.)

1924.

310. "Device for the synchronisation of and the prevention of hunting in single-phase and polyphase alterating current synchronous machines, more particularly as applied to clocks." R. Michl. January 12th, 1923. (209,735.)

1,649. "Electric power control systems." F. W. Hild. February 5th, 1923. (Divided application on 215,427.) (215,694.)

3,231. "Apparatus for electric re-heating for starting internal-combustion motors." British Thomson-Houston Co., Ltd. February 7th, 1923. (211,144.)

4,389. "Electric push button switches." M. Langegger. February 23rd, 1923. (211,874.)